ANNALS
OF THE
Association of American Geographers

VOLUME XIII SEPTEMBER, 1923 No. 3

# THE AGRICULTURE OF THE GREAT PLAINS REGION

O. E. BAKER

CONTENTS

| | Page |
|---|---|
| Introduction | 110 |
| Present Agricultural Situation | 110 |
| Boundaries and Division Lines | 112 |
| The Eastern Boundary of the Black-Earth Belt | 114 |
| The Western Boundary of the Black-Earth Belt | 115 |
| The Western Boundary of the Farming-Grazing Belt | 117 |
| The Boundaries of the Arid, Sandy, or "Badlands" Grazing Areas | 118 |
| The Western Boundary of the Great Plains | 119 |
| Area of the Great Plains Region | 119 |
| The Moisture Belts | 120 |
| The Black-Earth Belt | 120 |
| The Farming-Grazing Belt | 122 |
| The Grazing-Forage Crop Belt | 122 |
| The Arid, Sandy and "Badlands" Grazing Areas | 123 |
| Temperature Divisions of the Moisture Belts | 123 |
| The Spring Wheat Section | 124 |
| The Corn Section | 124 |
| The Winter Wheat Section | 124 |
| The Cotton Section | 124 |
| Crop Land in the Temperature Sections | 126 |
| The Crops of the Great Plains | 127 |
| Wheat | 127 |
| Oats, Barley, Rye and Flax | 134 |
| Corn and the Grain Sorghums | 136 |
| Hay | 136 |
| Cotton | 140 |
| The Farm Garden | 140 |
| Pasture in the Great Plains | 142 |
| Composition of the Pasture | 143 |
| Carrying Capacity of the Pasture | 143 |
| Live Stock in the Great Plains | 145 |
| Cattle | 148 |
| Horses and Mules | 148 |
| Sheep | 150 |
| Hogs | 150 |
| Agricultural Productivity | 152 |
| Productivity of the Moisture Belts | 152 |
| Factors Affecting Productivity | 155 |
| Size of Farms | 156 |
| Value of Products, not Acreage, the Measure of Size | 156 |
| Changes in Size of Farms | 158 |
| Systems of Farming in the Great Plains | 160 |
| Black-Earth Belt | 160 |
| The Farming-Grazing Belt | 162 |
| The Grazing-Forage Belt | 163 |
| Arid and "Badlands" Grazing Areas | 163 |
| The Irrigated Districts | 164 |
| The Agricultural Outlook | 164 |

INTRODUCTION.—The Great Plains is the term commonly used by the residents of the region, as well as by geographers, for that broad belt of land having more or less deficient rainfall, grass covered and largely of smooth to undulating surface, which slopes gradually eastward from the Rocky Mountains to the central portion of the continent where humid conditions of climate prevail. The climatic conditions, especially the supply of moisture, determine primarily the systems of agriculture and cause the Great Plains to be classified as a distinct agricultural region—not the topographic conditions as the term "Great Plains" would indicate. Indeed, large areas in the Great Plains contain much rough land, especially in the northern section where many of the rivers are now running several hundred to a thousand feet or more below the original level of the plain, descent to the rivers being usually by a series of broad steps, each bounded by a band of so-called "breaks," or "badlands." In the central plains of eastern Colorado and western Kansas, erosion is much less advanced and the term "plains" is quite appropriate; but in the southern plains, especially along the eastern margin of the Staked Plains and in west central Texas, much of the land is rough and broken. The Staked Plains, however, constitute probably the largest area of almost level land in the United States.

PRESENT AGRICULTURAL SITUATION.—This Great Plains region is the last frontier of agriculture in North America. Settlement is still in progress, and systems of farming adapted to the varying geographic conditions are not yet fully established. It is this economic aspect of the situation in the region, especially the problem of land utilization, that is here presented.

In the semi-arid portions of the northern Great Plains during the last few years banks have been failing; many farmers have gone bankrupt, or have left the country and their land without that legal formality; property values have depreciated, sometimes from as much as $30 an acre down to $5 or less. Partial depopulation has occurred locally; even a few county governments have defaulted payment on their bonds, and one of the states was compelled for a short time to pay its officials with promissory notes. In 1918-1919 the President allotted 5 million dollars from the War Emergency Fund for seed loans in this region largely, and in 1921 and 1922 Congress appropriated 2 millions and 1½ millions respectively for this purpose.

The central and southern parts of the Great Plains are at present in a fairly prosperous condition, but in years past these areas also have experienced periods of successive dry seasons, with economic consequences similar to those now occurring in the northern plains. The

central plains are better able now to endure years of adversity than the northern plains because they have been longer settled and the farmers have accumulated more capital.

This serious situation in the northern plains area is due only in part to the unprecedented drought of three years' duration (1917-1919). Other important factors are the price of grain during the past three years, which has been lower than the cost of production, and the inexperience of many of the settlers. A recent survey of the former occupations of settlers in a county in Montana showed that only half had previously been farmers and that 30 per cent arrived with no capital. The list includes musicians, butchers, bartenders, miners and deep sea divers, maiden ladies and merchants, preachers, plasterers, printers and peddlers, gamblers and jacks-of-all-trades. Of those with previous farming experience only 52 per cent have abandoned their farms, while 70 per cent of those without previous experience have left for other fields of work. Of those with capital 58 per cent have failed to stay, while of those with no capital 70 per cent have left.*

Perhaps of as great importance as the unsuitability of some of the settlers to pioneer farm life is the unsuitability of the systems of farming adopted by many in their ignorance of the geographic conditions, or because of their poverty. The selection of an unsuitable system of farming, moreover, often has been forced upon the settlers by the small size of the homestead permitted by law. Sixteen hundred acres in much of this region produces no more than 160 acres in the Eastern states. Fundamentally the situation is attributable in large measure to delay in the adoption of a national land policy suited to semi-arid climates. The settlers have had to make the best of an arbitrary law. This has usually involved the sale of land by one settler to an adjacent settler or rancher, and the consolidation of the holdings into a unit sufficient in size to support a family. Often this has meant blasted hopes and sometimes the waste of several years of the homesteader's life.

The serious situation in the Northern Great Plains has led the United States Department of Agriculture, in cooperation with the state agricultural colleges and experiment stations, to endeavor to determine with more or less precision the geographic conditions in the different portions of the Great Plains region and the systems of farming and size of farms which are necessary to support a family in

* This information was supplied by Mr. M. L. Wilson, of the Montana Agricultural College, who recently completed a study of the causes of success and failure of farmers in Hill County.

accordance with the American standard of living.* Many of the successful settlers in the region are recent immigrants who have survived the adverse seasons largely because of their low standards of living. But their children are not likely to be satisfied with less than the American standard, and if the agriculture of the region is to be permanent and satisfactory, it should afford nothing less than a comfortable living for the farmer and his family.

Boundaries and Division Lines.—The eastern boundary of the Great Plains is determined primarily by the amount of precipitation (rain, snow, and hail) and is indefinite. By some geographers it has been based directly on the amount of annual precipitation, with due reference to increasing evaporation with increasing temperature toward the south; by others it has been determined according to native vegetation, which changes both in composition and quantity with changes in rainfall; still others have seized upon slight breaks in the topography or physiographic structure in drawing the boundary lines; while a few geographers, but more particularly popular writers, have been content to place the eastern boundary at the 100th meridian. The boundary of an agricultural region should be drawn on the basis of its agriculture, but as the settlement of most of the Great Plains is recent and the agriculture is immature, it seems best at present to determine the eastern boundary on the basis of the color of the soil and depth to the layer of lime accumulation, as well as upon farm practices and systems of farming, which tend to vary with the climatic and soil conditions.

The color of the soil in this region is dependent principally upon the character and luxuriance of the native vegetation, which in turn is dependent largely upon the amount of precipitation in relation to the evaporation. The depth to the layer of lime accumulation in the soil (shown by a lighter color and by effervescence upon application of acid) is likewise dependent primarily upon the precipitation, which leaches out a portion of the lime and other salts from the surface soil and carries these alkalies down to the depth, apparently, of its normal penetration. The color of the soil in places of normal development (where not subject to erosion, deposition, poor drainage, etc.), and the depth to the layer of lime accumulation are permanent and readily recognizable. These indicators of the possibilities of agricultural utilization do not vary in quantity from year to year like the precipitation; nor in quality and luxuriance like the native vegetation; but

*A series of bulletins describing the physical conditions and agricultural situation in the Northern Great Plains is in preparation by the U. S. Department of Agriculture cooperating with the agricultural colleges in the states concerned.

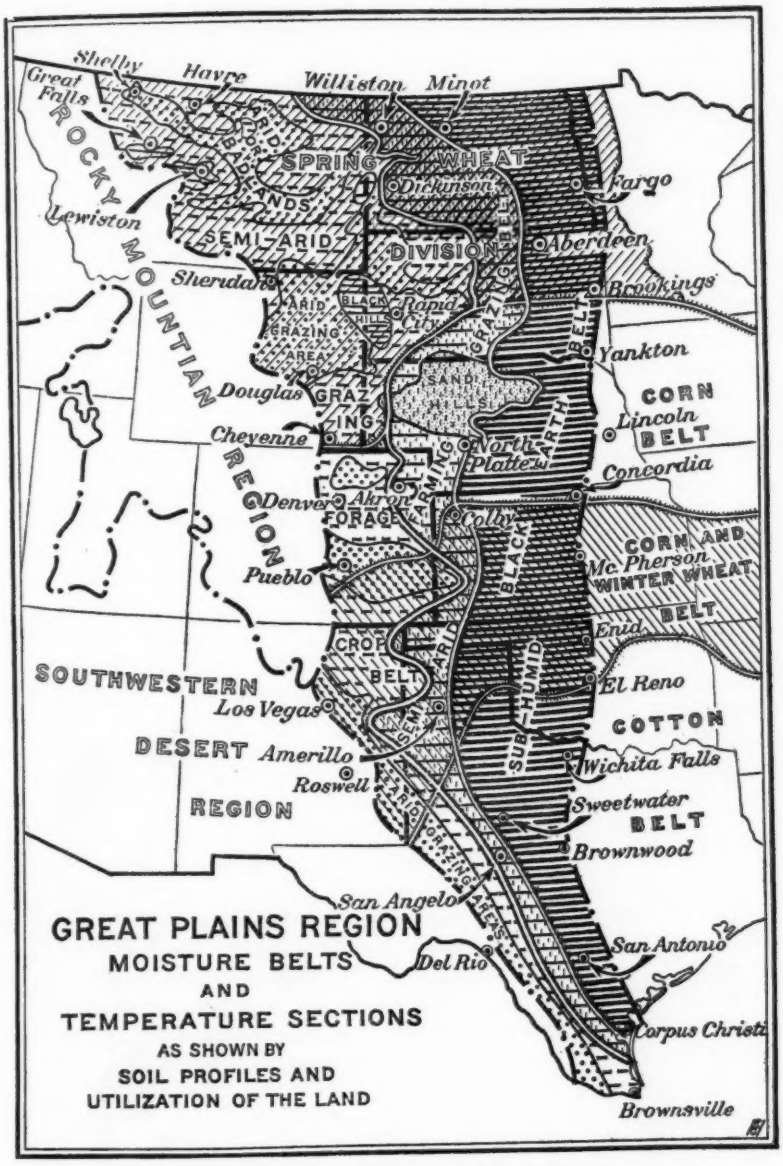



FIG. 1.—Climatic Belts of Great Plains Region.

represent the results of hundreds of years of development under the existing conditions, and, apparently, afford the simplest and safest criteria yet known of the adaptation of a district to the different systems of agriculture.*

The eastern boundary of this Great Plains region may be drawn (1) where the transition from humid to arid conditions first becomes noticeable in the soil and in the systems of farming, or (2) some distance west where the soil changes from black to dark brown in color and the acreage in pasture exceeds the acreage in crops, or (3) still further west where the soils become medium brown in color and the deficiency in moisture is so discouraging to crop production that farmers are compelled to place their principal dependence upon pasture and live stock, that is, where the value of the pasturage exceeds the value of the crops.

In this paper the zone where the influence of decreasing precipitation first becomes evident in the soil and in the sytsems of farming will be considered the eastern boundary of the Great Plains, in order that all of these moisture belts may be included in the discussion. But it should be noted that the second moisture line, i. e., where the acreage of pasture exceeds the acreage of crops, is of much greater significance agriculturally; and that the third line, where the value of the pasture exceeds the value of the crops, might be preferred as a boundary if one wished to restrict the Great Plains region to those areas in which pastoral systems of farming are dominant. Accepting the first line mentioned as the eastern boundary of the region for our present purpose, the second and third lines become significant interior division lines (Fig. 1).

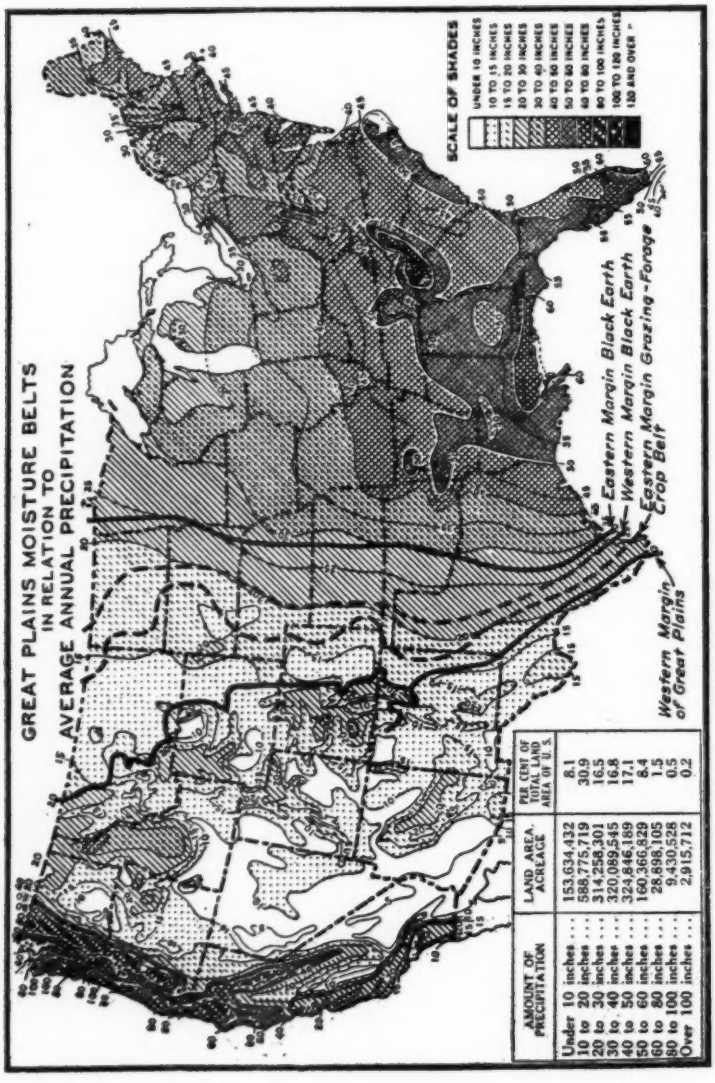
*The Eastern Boundary of the Black-Earth Belt.*—The eastern boundary of the Great Plains region is drawn where the layer of lime accumulation first becomes noticeable in the sub-soil of level, well drained, silty or clayey soils, usually at a depth of four to five feet, the rainfall being insufficient, apparently, to percolate entirely through the soil and carry away the lime and other salts in solution. The color of the soil also usually changes with the appearance of this layer of lime accumulation, the dark brown that characterizes the humid prairies developing into a positive black color. Along this zone timothy and clover give place to wild hay and alfalfa, the carrying capacity of the pasture decreases, corn, in general, begins to be less important and wheat more important, and listing becomes a common practice in the Central

* These soil criteria of agricultural utilization have been described more fully by Dr. C. F. Marbut, the vegetation criteria by Dr. H. L. Shantz, and the climatic criteria by Mr. J. B. Kincer in the June (1923) issue of the ANNALS.

Plains, particularly in Kansas and Oklahoma. The farms begin to increase in area, and, where other conditions are equal, a larger proportion of the land is in pasture.

This boundary line, or, to be more accurate, transition zone, follows along the eastern margin of the Red River Valley in Minnesota, passing near Thief River Falls, Detroit, and Fergus Falls, and, continuing southward and somewhat westward, crosses the state line into South Dakota, passing near Brookings and Yankton. The boundary then trends almost directly south across Nebraska, passing a few miles east of Norfolk and about 30 miles west of Lincoln. Near the Kansas line the boundary again veers slightly west and then continues straight south through Concordia and McPherson, Kan., Enid and El Reno, Okla., whence it veers a little westerly to Henrietta and Brownwood, Tex., then slightly easterly, and, passing near San Antonio, reaches the Gulf of Mexico at Corpus Christi (Fig. 1). The average annual precipitation along this easternmost boundary of the Great Plains increases from 22 inches in northwestern Minnesota to 29 inches in Nebraska and 30 inches in Oklahoma and Texas (Fig. 2).

*The Western Boundary of the Black-Earth Belt.*—From 125 to 175 miles west of this easternmost boundary of the Great Plains, except in North Dakota where the distance along the Canadian boundary increases to 320 miles, we come to the second line, which is one of the most distinct agricultural boundaries in the United States. This zone of rapid transition, where pasture acreage becomes greater than crop acreage and humid systems of farming give way to semi-arid systems, practically coincides with the change in color of soil from black on the eastern side in the Dakotas, Nebraska, and Kansas, or reddish black in Oklahoma and Texas, to a dark brown to the west. The layer of lime accumulation is found usually at 20 to 24 inches. The change in the productivity of the land, size of farms, and systems of farming along this line is, in general, abrupt. The value of farm land along almost the entire length of this line was close to twenty-five dollars an acre in 1919, and the average value of farm products in that year was about ten dollars per acre, except in North Dakota, where the drought reduced it to about seven dollars (Fig. 16). Fifty miles east the value of the farm products in most counties was over fifteen dollars per acre, fifty miles west it was under five dollars. Fifty miles east of this line the average size of farms is 300 to 400 acres, fifty miles west the farms average, in general, from 600 to 1200 acres. Fifty miles east of this line, indeed usually up to this line, the landscape looks like an agricultural picture in the humid prairie region. The land is practically all in fields and most of the fields are in crops.




| AMOUNT OF PRECIPITATION | LAND AREA, ACREAGE | PER CENT OF TOTAL LAND AREA OF U. S. |
|---|---|---|
| Under 10 inches | 153,634,432 | 8.1 |
| 10 to 20 inches | 588,775,719 | 30.9 |
| 20 to 30 inches | 314,258,301 | 16.5 |
| 30 to 40 inches | 320,089,545 | 16.8 |
| 40 to 50 inches | 324,846,189 | 17.1 |
| 50 to 60 inches | 160,366,829 | 8.4 |
| 60 to 80 inches | 28,698,105 | 1.5 |
| 80 to 100 inches | 9,430,528 | 0.5 |
| Over 100 inches | 2,915,712 | 0.2 |

FIG. 2.—Moisture Belts and Precipitation.

Fifty miles west of this line the landscape in general looks like the plains. The fences usually are far apart, often lacking altogether, except along the roads, and more than half of the land is still covered with the native grass and used for pasture.

This line divides the United States into two parts almost equal in area. To the east is the region of humid climate farming, based upon tilled crops, small grains, and tame hay and pasture, though in eastern North and South Dakota and in Minnesota much wild hay also is cut. To the west is the region of dry-farming, grazing, and irrigation farming. East of this line the natural vegetation is composed largely of the andropogons and other tall or prairie grasses; west of this line, except on sandy soils, the dominant vegetation is grama, buffalo grass, and other short or plains grasses. For native vegetation as well as for cultivated crops this seems to be a critical line beyond which humid climate plants grow well only under unusually favorable conditions.

This line crosses the Canadian boundary near Portal, No. Dak., and trends southeasterly along the outer edge of the glacial moraines that cap the Missouri Coteau to within a few miles of Carrington, No. Dak., where it turns southward on the 99th meridian, passing through Leola, Faulkton and Miller to Gann Valley, So. Dak. Thence the line turns southwestward, crosses the Missouri River and passes a little to the west of Burke, So. Dak., then swings sharply southeasterly to O'Neill, Nebr., then southerly and westerly around the Sand Hills to North Platte, Nebr. From North Platte the line turns south again, first bending a little west to Atwood, Kan., then a little east, passing near Hoxie, Gove, Dighton and Cimarron. From Cimarron the line trends southwesterly through Liberal, Kan., to Amarillo, Tex., on the Staked Plains. South of Amarillo the line is again deflected toward the east, passing near Floydada, Snyder, and San Angelo. Crossing the Edwards Plateau, whose soils are mostly too shallow to possess a normal color or reveal a profile, the line reappears about 20 miles west of San Antonio, and, passing through Alice, reaches the Gulf of Mexico southeast of Kingsville (Fig. 1). The average annual precipitation along this line increases from 16 inches in northwestern North Dakota to 19 inches in east central South Dakota, 21 inches in southern Nebraska, and also in the Texas Panhandle, and 25 inches in southern Texas (Fig. 2).

*The Western Boundary of the Farming-Grazing Belt.*—From 50 to 150 miles west of this second line we come to the third line, which is drawn through those localities where the product of the pasture becomes of greater value than the crops; in other words, where cattle and sheep

ranching become the dominant systems of farming. This line is characterized along most of its length by a change in color of the soil from a dark brown to a medium brown, and the layer of lime accumulation rises to within 16 to 18 inches of the surface. The line crosses from Canada into the United States near Opheim, in northeastern Montana, and, after passing a few miles south of Scobey and Plentywood, Mont., turns south near Williston, No. Dak., and runs along the east side of the Little Missouri "breaks" about to Amidon, whence it trends southeasterly to the Missouri River at the South Dakota line, and follows the river to Pierre.* At Pierre the line turns southwesterly passing near Kadoka, So. Dak., and Chadron, Alliance, and Sidney, Nebr. From near Sidney the line swings southeast almost to Julesburg, Colo., then circles through Akron and Cheyenne Wells, Colo., to Tribune and Garden City, Kan. Thence the line turns southwesterly again to Elkhart, Kan., and Clayton, N. Mex., then southeast to Dalhart and Tascosa, Tex., and then southwest to include Curry County, N. Mex. The boundary then turns southeasterly through Portales, N. Mex., Brownfield and Big Spring, Tex., and after crossing the stony Edwards Plateau, passes about 10 miles east of Uvalde and Hebbronville and reaches the Gulf of Mexico near Brownsville.

The average annual precipitation along this line increases from 15 inches in northeastern Montana to 17 inches in central South Dakota and western Nebraska, 18 inches in eastern Colorado, eastern New Mexico and west central Texas, and 25 inches in extreme southern Texas, where the rainfall is more irregular and often torrential.

*The Boundaries of the Arid, Sandy, or "Badlands" Grazing Areas.*—Other boundaries deserving notice are those delimiting the driest areas where practically no crops are grown without irrigation, except a little corn, kafir or sorghum, and sweet clover for forage, usually on land which receives flood water from higher lands or possesses other favorable conditions. This almost purely pastoral agriculture is found also on lands of rough topography, or on very sandy soils, which preclude cultivation. These districts of arid climate, rough surface, or sandy soil do not form a continuous belt, but include in the aggregate a large area.

In Montana these grazing lands are found in the warm, dry valleys of the Yellowstone, Missouri, Musselshell, and Marias rivers, where the average annual precipitation is below 14 inches, and include also much of the valley of the Milk River. In North Dakota the badlands

* The Golden Valley lying along the Montana-North Dakota boundary on the western side of the Little Missouri Badlands possesses climatic conditions similar to those east of this line.

of the Little Missouri river is the only large area given over exclusively to grazing. In South Dakota these grazing lands include the badlands along the Cheyenne and White rivers, most of Harding and Butte counties, and those portions of Perkins and Meade where the average annual precipitation is less than 15 inches. Most of northeastern Wyoming belongs to this grazing type of land. In Nebraska the Sand Hills constitute the principal area, but parts of Sioux and Dawes Counties should also be included. In Colorado much of the unirrigated land in the South Platte and most of that in the Arkansas valley are suitable only for grazing, as is also most of the southeastern portion of the state in which the average annual precipitation is less than 16 inches. In Kansas only the Arkansas Valley west of Hartland and the sand hills to the south are included, and in eastern New Mexico, the Pecos Valley and drier portions of the upper Canadian Valley. In Texas practically all the area west of Midland, Sonora, Carrizo Springs and Hebbronville is suitable only for grazing, except where irrigated. In the Rio Grande Valley 20 inches of average annual precipitation is the minimum required for profitable crop production (Figs. 1 and 2).

*The Western Boundary of the Great Plains.*—The western boundary of the Great Plains follows along the foothills of the Rocky Mountains a distance of nearly 2,000 miles from the Peace River Valley of northern Alberta to the Pecos Valley of Southeastern New Mexico, where, because of the desert conditions existing in this valley, it crosses to the eastern side of the valley and continues southeasterly to about Odessa, Tex. South of Odessa it again approaches the Pecos River and continues southeasterly at a distance of 10 to 25 miles east of the Pecos river and Rio Grande nearly to Hidalgo, where the line crosses into Mexico and probably reaches the Gulf of Mexico about 75 miles south of Brownsville. The Great Plains Region, in other words, is bounded on the west for about 2,000 miles by the Rocky Mountain front (except for the gap in Wyoming between the Big Horn and the Laramie ranges), but for 500 miles along its southern extension it is bounded by the southwestern desert, and the boundary, accordingly, is less definite.

Area of the Great Plains Region.—As thus defined the Great Plains, including the sub-humid Black-earth belt, is a region about 2,400 miles long by 800 wide at its greatest breadth (along the United States-Canadian line) and contains an area of about 600 million acres, of which approximately 175 million acres are in Canada, 420 millions in the United States, and 5 millions in Mexico. In its southern extremity in Mexico, which is subtropical and almost frostless, palms

and citrus fruits are grown; while in its northern extremity in Canada only the hardiest crops can be raised, because of the frosts that are likely to occur any time in the summer. Along its eastern margin the climate is humid, while in southern New Mexico and Texas it is bounded on the west by the desert. Topographically it is one of the most uniform regions in North America, but climatically it is one of the most diverse. Owing, however, to the relatively uniform topography the climate changes, in general, are gradual and often almost imperceptible.

THE MOISTURE BELTS.—The three lines just described, that lie between the eastern and western boundaries of the Great Plains, divide the region into four moisture belts or areas,—(1) a sub-humid, black-earth crop farming belt, (2) a semi-arid farming-grazing belt, in which crops are dominant from the standpoint of value, (3) a more arid grazing-forage crop belt, in which grazing is more important than crop production, and (4) a series of disconnected arid, sandy or rough areas, which unirrigated are suitable only for grazing and the growth of drought resistant forage crops on favorable sites (Figs. 1 and 3).

*The Black-Earth Belt.*—Largest in area and most important agriculturally is the sub-humid, black-earth, crop-farming belt. This is the first transition zone between the humid East and the arid West. It is one of the most productive agricultural areas in North America. The normally high fertility of the unleached soil just about balances the defect of frequently deficient rainfall. The use of land for crops is limited primarily by topography rather than by climate. Farms average in size about one-third of a section of land (200 acres) along the eastern edge of the belt, and about a section (640 acres) along the western boundary, the average for the entire belt being 325 acres. The area of this Black-Earth belt in the United States is about 144 million acres, and it contained in 1919 about 380,000 farms.

The agricultural conditions in this belt are admirably summarized by Mr. John Cole, Bureau of Plant Industry, in a memorandum to the writer as follows: "In this belt agriculture is established and proven by a history of more than a generation. While more subject to drought, the production of important crops is not far below that of the more humid section. The limited supply of water, however, operates against the increase of production through intensive methods and specialization. This is the area in which grain farming on an extensive scale has been profitable. Rotation and practices to increase or maintain production per acre are primary problems here. Modification of the grain farming system by the introduction of other crops carries with it the introduction of live stock to consume them, and so

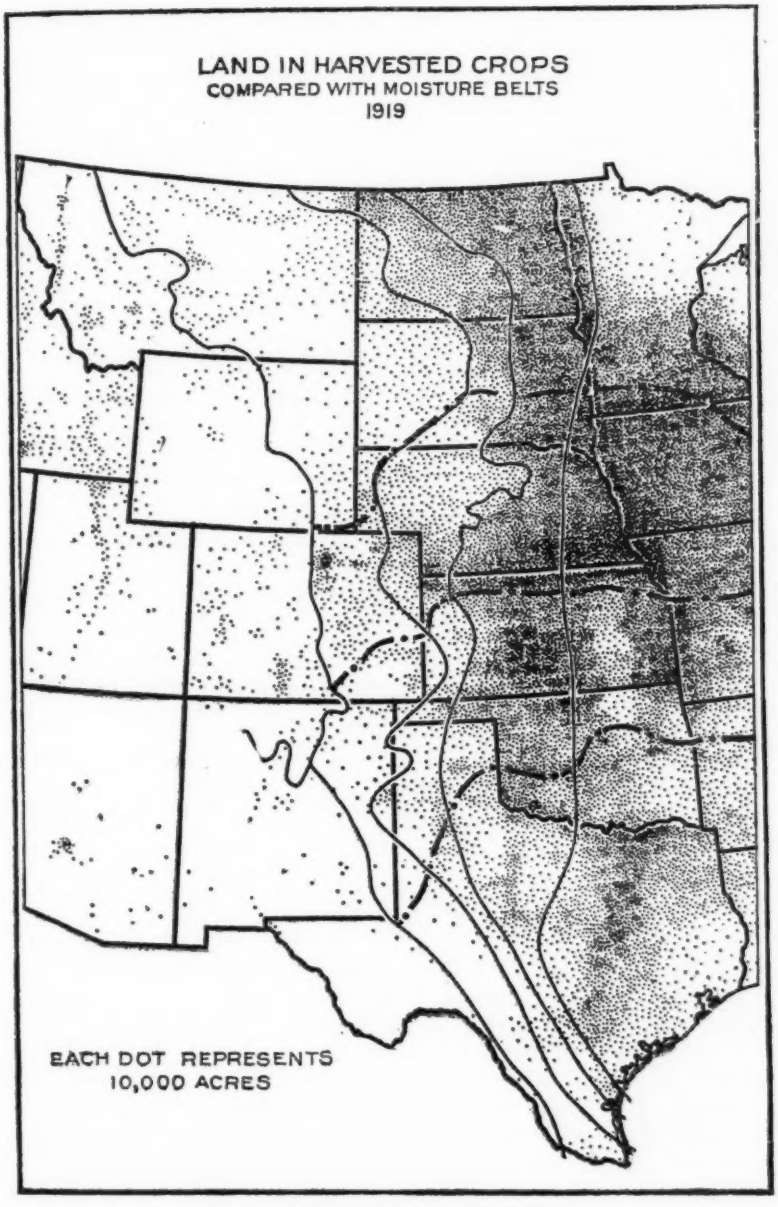



FIG. 3.—Distribution of Harvested Crops.

results in diversification as well as increased yields of the primary crops."

*The Farming-Grazing Belt.*—The second belt, which adjoins the Black-Earth belt on the west, and includes also the Judith Basin in Montana and certain moister benches on outwash plains beneath the Rocky Mountains, is the semi-arid Farming-Grazing belt. It is characterized by very dark to dark brown soils, with the layer of lime accumulation at a depth of one to two feet, and has a short grass vegetation, except on sandy soils. In this belt crop production, though uncertain, is more important than live stock production, except in dry years, when the live stock must provide most of the livelihood. One to two sections of land (640-1280 acres) are needed normally to yield a comfortable living. The average size of farms in the belt is only 683 acres, but much land not in farms is used for grazing, and if this were included the average size of farms would be about 900 acres. The area of this belt is about 81 million acres, and it contained in 1919 about 90,000 farms.

Mr. Cole summarizes the agricultural situation in this belt as follows: "Production is determined by the quantity of water available. The certainty of crop production is reduced more than the average yield in comparison with the more humid sections. Agricultural development has so far been determined by the uncertainty, by periodic production, more than by average production. The lack of available water operates entirely against increasing production by intensive methods. The necessity of reducing cost of production through extensive methods is indicated. Stabilization through the use of live stock to insure the continuance of the agricultural unit as a going concern through the poor years, in order that the returns of the good years may be realized, is an indicated necessity. Corn, wheat, native sod, bromegrass, and alfalfa, with live stock, is the dominant farm type indicated."

*The Grazing-forage Crop Belt.*—The third belt is the still drier, semi-arid Grazing-forage crop belt. The soils are typically brown to dark brown and the vegetation is largely grama grass mixed with nigger wool (*Carex filifolia*) in the north, buffalo grass in the central portion, and mesquite grass in the south. Wheat grass grows on heavy soils, especially in the north, and the tall grasses are often present on sandy soils. Crop production is precarious and the frequency of failure sufficient to reduce the average acre-yields to about three-fourths of those in the Farming-Grazing belt and to three-fifths those in the sub-humid Black-Earth belt. Crop production, however, can probably be carried on with profit in favorable sites, particularly if

extensive methods of cultivation are used and per acre cost is kept low. As Mr. Cole has noted,—" The primary object of cultivation in this belt is to produce feed-stuff, with an addition to the income from the uncertain but sometimes heavy crop of wheat produced at relatively small expense as a part of the rotation." Two to four sections of land (1280 to 2500 acres) are usually needed to make a family size farm. The area of the belt is about 120 million acres, and it contained in 1919 about 98,000 farms, excluding those in irrigated districts. This is only about 1225 acres per farm, but few of the farms in this belt, especially those recently started, are large enough to support a family in accordance with the American standard of living. Practically the only crops grown, other than wild hay, are wheat and corn or the grain sorghums for forage, except in southern Texas, where a little cotton is being raised. The corn is largely replaced by the sorghums in the Arkansas Valley and southward. Less than four per cent of the land was in harvested crops in 1919.

*The Arid, Sandy and " Badlands " Grazing Areas.*— Lastly to be noted are the arid, sandy, or " badlands " grazing areas. The soils in the arid areas are brown to ashy gray in color, and in the more arid portions the lime layer is near or at the surface. In such places the surface soil will effervesce upon application of acid. In these drier portions, which usually occupy the warm river valleys beneath the general level of the surrounding plains, crop production is normally impossible, except by irrigation. As already noted, rough lands, sand hills, " breaks," and " badlands " are included in these grazing lands, even where the rainfall is sufficient for crop production.

The drier lands in these arid areas are better suited usually to sheep than to cattle and 5,000 to 10,000 acres will often be required to support a fair sized outfit. On the " benches " and in the less arid portions about 25 acres in the northern plains to 50 acres in the southern plains will carry a cow or steer in a system of year-long grazing, and the number of acres required per farm may be only 2,500 to 5,000. The aggregate area of these arid and badlands grazing areas is about 70 million acres. Most of the irrigated land in the Great Plains region is found in these arid areas.

Temperature Divisions of the Moisture Belts.—These north-south trending moisture belts, more particularly the two eastern belts in which crops are more important than live stock, require division into sections, owing to their wide range in temperature conditions (Fig. 1). The most helpful division from an agricultural standpoint is that based on the dominant crops. But within the temperature zone suitable for cotton production the topographic peculiarities of this very diversified section must also be recognized.

*The Spring Wheat Section.*—The northern plains are characterized by the dominance of spring wheat. This section, which is the largest in area and importance among these temperature cross-zones, extends from the spruce and aspen forests of northern Saskatchewan and Alberta southward to central South Dakota, northwestern Nebraska and southwestern Wyoming. South and east corn becomes the dominant crop. Nearly all the flax in the United States and Canada is grown in this region, as is also much of the rye and barley. Wild hay is a very important crop.

*The Corn Section.*—The central plains require sub-division into northern and southern sections. The northern section is characterized by the dominance of corn, and extends from central South Dakota and west central Nebraska southwestward to eastern Colorado. It includes the northern tier of counties in Kansas. Winter wheat is a very important crop in this section also, but is not dominant except in three counties in south-central Nebraska, which are surrounded by corn-dominant counties. Winter wheat exceeds both spring wheat and corn in acreage also in a tier of counties along the northwest margin of this corn area in western Nebraska and north central Colorado.

*The Winter Wheat Section.*—The southern section of the central plains and the northern and western portions of the Staked Plains of Texas are characterized by the dominance of winter wheat, corn, and the grain sorghums. In the northeastern and eastern part of this winter wheat section the corn acreage exceeds that of the sorghums, but to the south and west the sorghums become more important, and in some counties even exceed wheat in acreage. This winter wheat, sorghum, and corn section of the Great Plains includes all of western Kansas, except the northern tier of counties, the Arkansas Valley of Colorado, all of New Mexico included within the Great Plains, the western and northern portion of the Texas Panhandle, and all of Oklahoma north and west of El Reno. To the south and east of this section cotton is the dominant crop.

*The Cotton Section.*—The cotton-growing section of the Great Plains requires subdivision into six districts on the basis primarily of topography and the relative importance of crops compared with pasture. The six districts include portions, respectively, of the Staked Plains, the Red Prairies and Breaks, the West Cross Timbers, the Grand Prairie, the Edwards Plateau, and the Gulf Coastal Plain (Fig. 4).

The Staked Plains district includes only that portion of the Staked Plains in which cotton is the dominant crop. The other important crops are the sorghums, corn, and wheat. The Breaks to the east have

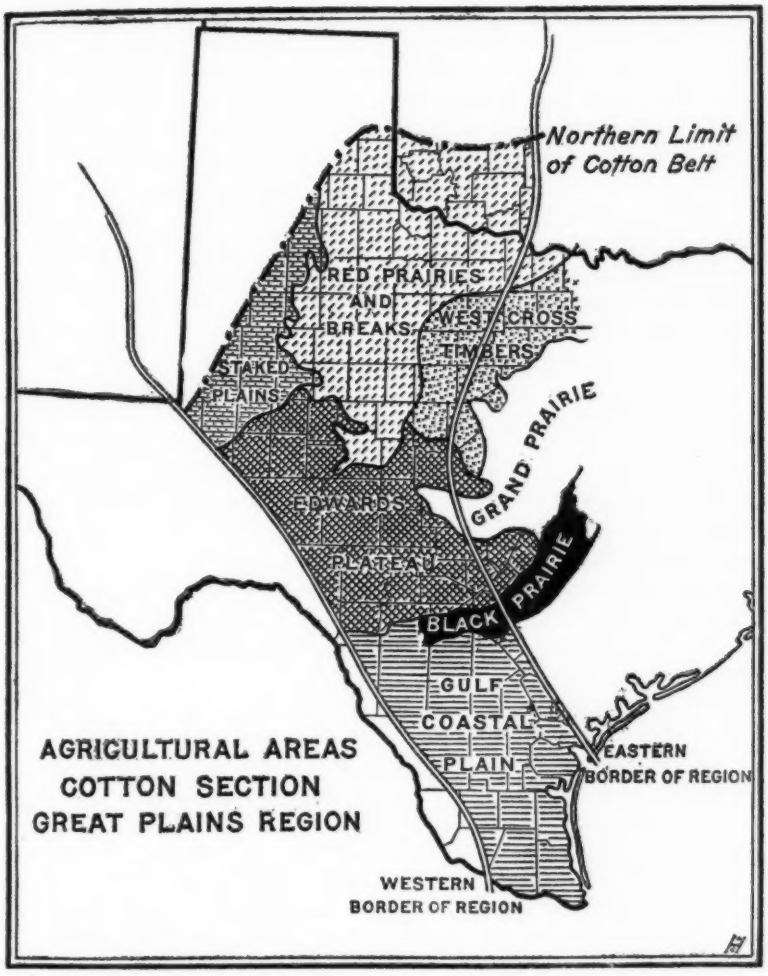



FIG. 4.—Agricultural Areas of Cotton Section.

little tillable land, and are used mostly for pasture. On sufficiently level areas of sandy soil the sorghums, corn, and a little cotton are grown, and on the harder soils occasionally a field of wheat also is seen. The Red Prairies, which include southwestern Oklahoma and much of north central Texas, contain some fairly good land, on which wheat, cotton, corn, and the sorghums principally are grown. The West

Cross Timbers include a large proportion of rough stony land, mostly covered with a scrubby oak forest. On the smoother and more fertile lands cotton, corn, wheat, and the sorghums are grown. The Grand Prairie projects only its western tip into the Black-Earth Belt, and has been made to include the granitic soils of Mason County.

A little south of Big Spring, San Angelo and Brady, Tex., the land rises, by low steps or escarpments, and becomes the Edwards Plateau. This is a limestone country with soil so thin in its central portion that not 10 per cent could be cropped even where the rainfall permitted. But it is a beautiful park-like country of short grass pastures with intermingled clumps of live-oak or mesquite, and a few junipers on the steepest slopes. The mesquite grass forms a sod beneath as well as between the trees, and upon this vegetation cattle, sheep, and goats are grazed. The cattle eat the grass, the sheep keep down the weeds, and the goats browse the brush and restrain the forest from intruding further upon the grassland. In the eastern moister portion of the Edwards Plateau the oak and mesquite become denser, forming a scrubby forest, while in the western portion the trees are scattered, dwarf, and finally disappear. In the eastern part of the Plateau a little wheat is raised by the German farmers in the narrow valleys between the limestone ridges. During the winter the wheat is pastured by sheep.

The Edwards Plateau slopes down more or less abruptly on the south, at the latitude of San Antonio and Del Rio, into the Gulf Coastal Plain, an area characterized by black lands along the coast, red semi-arid lands further inland, and ashy gray to yellow desert lands along the Rio Grande. Cotton, kafir, and corn are grown on farms sparsely scattered among the mesquite and thorn-bush dwarf forest westwardly to within 30 miles of the Rio Grande. Palms are planted for ornament throughout the area, and in the irrigated district along the lower Rio Grande many citrus orchards have been set out.

*Crop Land in the Temperature Sections.*—In the spring wheat and corn sections of the Black-Earth belt two-thirds of the farm area is in crops, a higher proportion than in the Corn Belt proper; in the winter wheat section, about one-half of the farm land is in crops; and in the cotton section less than one-third of the farm land (Fig. 3). In the spring wheat section there are 200 acres in crops per farm, in the corn and winter wheat sections 160 and 170 acres respectively, and in the cotton section 100 acres.

Similarly in the spring wheat section of the Farming-grazing belt, about one-third of the farm area is in crops (as compared with two-thirds in the Black-Earth belt to the east); in the section where corn

is the leading crop, which includes the Nebraska Sand-hills where almost no crops are grown, 29 per cent of the farm land is in crops; in the winter wheat and grain sorghum section, which includes much of extreme western Kansas and the western portion of the Texas Panhandle, 22 per cent of the farm land is in crops, and in the Cotton section 8 per cent. In the spring wheat and corn sections of this belt there are about 230 acres of crops per farm, in the winter wheat section about 140 acres, and in the cotton section about 85 acres.

THE CROPS OF THE GREAT PLAINS.—The principal crops in the Great Plains region are wheat, oats, barley, rye, corn, the sorghums, hay, and cotton. Sugar beets are also an important crop in the irrigated districts. Table I shows for the belts and temperature divisions the total acreage of harvested crops in 1919, the acres and value of all crops per square mile, the per cent of crop land in each important crop, the yield per acre, and the per cent the value of each important crop was of the value of all crops. It will be noted that the average acres of crops harvested in 1919 per square mile of land area (640 acres) decreased from 280 acres in the Black-Earth belt to 122 acres in the Farming-grazing belt, 40 acres in the Grazing-forage Crop belt, and 26 acres in the Arid and Badlands areas, which contain much irrigated land. The value of the crops per square mile likewise decreased from about $7,400 in the Black-Earth belt to $2,100 in the Farming-grazing belt, $850 in the Grazing-forage Crop belt, and $690 in the Arid and Badlands areas. If irrigated crops were excluded in these arid areas, the value of the crops per square mile would be about $200 (Figs. 1 and 3.)

*Wheat.*—The leading crop in the Black-Earth belt is wheat (Fig. 5). This is true also of the black-earth belts in Russia and in Argentina. About one-third of the wheat acreage and production in the United States and about one-tenth of the wheat acreage in the world are in this Black-Earth belt. In the winter wheat section of the belt, wheat contributed 60 per cent of the acreage of all crops in 1919. In the spring wheat section, wheat contributed about 44 per cent of the acreage of all crops, and receipts from the sale of wheat constituted from one-fourth to three-fourths of the farmers' income, varying with locality. In the Black-Earth belt as a whole, wheat constituted about 40 per cent of the acreage of all crops harvested in 1919; in the Farming-grazing belt, about 31 per cent; in the Grazing-forage crop belt, about 27 per cent; and in the arid areas, 26 per cent, of which a considerable proportion was irrigated. The acreage of wheat in the Black-Earth belt has decreased notably since 1919 and it constitutes now probably no greater proportion of the crop land than in the semi-arid belts and arid areas to the west.

TABLE

GREAT PLAINS

ACRES AND VALUE OF THE CROPS PER SQUARE MILE, RELATIVE

| | Acreage of all Crops | Acres Per Sq. Mile | Value Per Sq. Mile | Wheat Percentage of | | Wheat Yield Per. Acre Bushels | Oats Percentage of | | Oats Yield Per. Acre Bushels |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | |
| Great Plains Total..... | 86,967,504 | 138 | 3314 | 37.0 | 34.1 | 10.0 | 7.5 | 5.7 | 23.5 |
| Black-Earth Belt..... | 58,959,391 | 280 | 7389 | 40.6 | 36.4 | 10.7 | 9.1 | 6.6 | 24.8 |
| Spring Wheat Section... | 20,725,152 | 378 | 7238 | 44.1 | 43.7 | 8.0 | 13.0 | 9.8 | 18.5 |
| Corn Section..... | 14,832,655 | 362 | 9454 | 27.3 | 26.4 | 11.7 | 9.9 | 8.5 | 29.7 |
| Winter Wheat Section.. | 15,193,557 | 264 | 6470 | 59.9 | 62.6 | 11.9 | 4.1 | 3.9 | 29.6 |
| Cotton Section..... | 8,208,027 | 144 | 6982 | 20.1 | 14.3 | 16.4 | 6.8 | 4.1 | 36.5 |
| Farming-Grazing Belt..... | 18,753,009 | 122 | 2122 | 30.8 | 32.8 | 8.4 | 4.5 | 3.8 | 18.7 |
| Spring Wheat Section... | 8,763,110 | 163 | 1975 | 40.0 | 40.3 | 5.2 | 6.0 | 5.2 | 13.4 |
| Corn Section..... | 6,828,800 | 132 | 2410 | 22.0 | 35.5 | 13.8 | 2.5 | 2.1 | 20.5 |
| Winter Wheat Section.. | 2,261,819 | 84 | 2114 | 32.7 | 34.3 | 12.3 | 2.8 | 3.1 | 34.5 |
| Cotton Section..... | 899,280 | 42 | 1808 | 2.4 | 1.7 | 14.4 | 9.2 | 6.4 | 37.0 |
| Grazing-Forage Crop Belt. | 6,372,947 | 40 | 848 | 27.3 | 20.2 | 7.1 | 3.7 | 2.5 | 15.0 |
| Spring Wheat Section... | 3,732,048 | 39 | 588 | 32.2 | 23.7 | 4.8 | 4.4 | 3.1 | 12.0 |
| Corn Section (a)..... | 1,382,175 | 88 | 2294 | 30.3 | 26.5 | 11.1 | 2.9 | 1.9 | 18.0 |
| Winter Wheat Section.. | 943,730 | 29 | 786 | 12.2 | 15.0 | 16.4 | 2.9 | 3.0 | 26.6 |
| Cotton Section (a)..... | 314,994 | 25 | 1170 | 0.6 | 0.2 | 9.8 | 1.2 | 0.6 | 28.5 |
| Arid & Bad Land Areas (a) | 2,882,157 | 26 | 690 | 26.2 | 15.4 | 7.2 | 2.9 | 1.9 | 18.0 |
| Spring Wheat Section... | 1,479,133 | 24 | 306 | 33.5 | 21.6 | 3.5 | 3.4 | 2.4 | 10.0 |
| Corn Section..... | 482,789 | 120 | 5270 | 32.1 | 19.4 | 12.9 | 2.8 | 1.5 | 24.5 |
| Winter Wheat Section.. | 824,847 | 32 | 1184 | 12.8 | 11.5 | 16.3 | 2.5 | 2.0 | 22.2 |
| Cotton Section..... | 95,388 | 5 | 276 | 0.3 | 0.2 | 14.7 | 1.0 | 0.5 | 36.9 |

(a) A large proportion of the acreage is irrigated, especially in the North Platte Valley included in the Corn
(b) In the Central Plains especially much of the corn grown for grain is also used for forage, consequently there
(c) Less than one-tenth of one per cent.

I

REGION

IMPORTANCE OF THE PRINCIPAL CROPS, AND YIELD PER ACRE, 1919

| Barley Percentage of | | Barley Yield Per Acre Bushels | Rye Percentage of | | Rye Yield Per Acre Bushels | Corn Grain (b) Percentage of | | Corn Grain Yield Per Acre Bushels | Corn Silage Percentage of | | Corn Silage Yield Per Acre Tons |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | |
| 3.2 | 2.4 | 15.4 | 4.3 | 1.9 | 7.4 | 12.4 | 14.3 | 20.4 | 0.4 | 0.7 | 4.4 |
| 3.4 | 2.5 | 16.4 | 3.9 | 1.7 | 7.9 | 13.6 | 15.4 | 22.1 | 0.5 | 0.7 | 4.6 |
| 6.9 | 6.0 | 14.2 | 9.2 | 5.3 | 7.5 | 3.5 | 5.7 | 24.0 | 0.4 | 0.9 | 5.1 |
| 2.0 | 1.7 | 20.6 | 1.3 | 0.7 | 9.9 | 34.7 | 41.7 | 23.2 | 0.4 | 0.7 | 4.9 |
| 1.8 | 1.8 | 22.7 | 1.1 | 0.6 | 9.3 | 8.7 | 7.6 | 15.2 | 0.8 | 1.1 | 4.0 |
| 0.3 | 0.2 | 29.2 | 0.1 | 0.1 | 14.1 | 10.2 | 7.1 | 25.0 | 0.1 | 0.1 | 6.0 |
| 3.4 | 2.7 | 12.3 | 6.2 | 3.6 | 6.8 | 10.4 | 12.3 | 15.2 | 0.2 | 0.2 | 3.1 |
| 4.4 | 4.2 | 9.9 | 10.2 | 7.6 | 6.2 | 3.1 | 5.5 | 16.0 | 0.1 | 0.2 | 2.5 |
| 2.1 | 2.1 | 15.6 | 3.9 | 2.6 | 8.7 | 21.1 | 22.0 | 14.0 | 0.1 | 0.2 | 2.9 |
| 4.3 | 3.0 | 16.6 | 0.4 | 0.4 | 13.2 | 4.1 | 4.0 | 16.8 | 0.3 | 0.3 | 3.4 |
| 0.1 | 0.1 | 26.7 | (c) | (c) | 12.5 | 15.1 | 12.0 | 25.4 | 0.2 | 0.3 | 5.5 |
| 1.1 | 0.9 | 13.3 | 3.0 | 1.2 | 5.5 | 9.6 | 10.7 | 16.2 | 0.6 | 0.9 | 3.4 |
| 0.8 | 0.7 | 10.2 | 3.6 | 1.5 | 4.2 | 3.4 | 3.8 | 11.8 | 0.1 | 0.2 | 2.9 |
| 1.9 | 1.4 | 15.5 | 3.5 | 1.5 | 7.8 | 19.6 | 14.3 | 13.6 | 1.9 | 2.4 | 3.4 |
| 1.3 | 1.0 | 16.4 | 0.8 | 0.6 | 13.1 | 16.0 | 17.9 | 20.2 | 0.4 | 0.5 | 3.8 |
| (c) | (c) | 7.2 | (c) | (c) | 14.5 | 19.8 | 15.7 | 27.2 | 0.9 | 0.8 | 4.4 |
| 1.4 | 1.3 | 19.0 | 2.5 | 0.5 | 3.7 | 6.9 | 5.1 | 14.2 | 0.8 | 1.5 | 5.2 |
| 0.7 | 0.6 | 7.9 | 4.3 | 1.7 | 3.2 | 2.5 | 2.8 | 9.9 | 0.1 | 0.2 | 2.5 |
| 3.4 | 2.1 | 20.7 | 0.8 | 0.1 | 3.8 | 5.1 | 1.5 | 9.2 | 2.2 | 2.5 | 5.0 |
| 1.6 | 1.4 | 25.5 | 0.6 | 0.2 | 8.7 | 14.7 | 8.8 | 15.9 | 1.2 | 1.9 | 5.8 |
| (c) | (c) | 21.2 | (c) | (c) | 15.0 | 15.0 | 7.0 | 19.1 | 0.4 | 0.3 | 3.9 |

Section, and in the Cotton Sections of Southern Texas.
is some duplication of acreage in these items.

TABLE I—

GREAT PLAINS

| | Corn Forage (b) Percentage of | | Corn Forage Yield Per Acre Tons | Sorghum Grain Percentage of | | Sorghum Grain Yield Per Acre Bushels | Sorghum Forage Percentage of | | Sorghum Forage Yield Per Acre Tons |
|---|---|---|---|---|---|---|---|---|---|
| | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | |
| Great Plains Total | 1.9 | 1.5 | 1.6 | 3.5 | 3.6 | 20.4 | 3.7 | 3.5 | 1.6 |
| Black-Earth Belt | 1.8 | 1.5 | 1.8 | 3.5 | 3.3 | 20.3 | 3.3 | 3.0 | 1.7 |
| Spring Wheat Section | 2.4 | 3.6 | 2.2 | (b) | (b) | 6.3 | (b) | 0.1 | 2.7 |
| Corn Section | 1.4 | 1.1 | 1.8 | 0.7 | 0.1 | 14.9 | 2.0 | 1.6 | 2.2 |
| Winter Wheat Section | 2.1 | 1.0 | 1.4 | 7.0 | 5.4 | 15.0 | 6.3 | 5.5 | 1.7 |
| Cotton Section | 0.4 | 0.1 | 0.8 | 12.0 | 7.6 | 26.2 | 8.3 | 4.9 | 1.6 |
| Farming-Grazing Belt | 1.6 | 1.3 | 1.2 | 4.0 | 5.7 | 20.6 | 4.0 | 5.2 | 1.5 |
| Spring Wheat Section | 1.5 | 2.1 | 1.2 | (b) | (b) | 1.6 | 0.1 | 0.1 | 1.6 |
| Corn Section | 2.1 | 1.5 | 1.2 | (b) | (b) | 8.4 | 2.9 | 2.5 | 1.4 |
| Winter Wheat Section | 0.8 | 0.5 | 1.4 | 27.2 | 25.8 | 19.2 | 19.5 | 19.1 | 1.6 |
| Cotton Section | 0.4 | 0.1 | 0.9 | 15.0 | 10.8 | 26.8 | 11.2 | 7.8 | 1.6 |
| Grazing-Forage Crop Belt | 3.1 | 1.9 | 0.9 | 3.7 | 4.7 | 21.0 | 5.4 | 5.7 | 1.5 |
| Spring Wheat Section | 2.8 | 2.1 | 0.8 | (b) | (b) | 1.5 | 0.2 | 0.3 | 1.3 |
| Corn Section | 5.3 | 2.9 | 1.1 | 0.6 | 0.3 | 15.4 | 6.1 | 3.8 | 1.3 |
| Winter Wheat Section | 1.7 | 0.8 | 1.0 | 20.2 | 19.5 | 20.4 | 22.6 | 18.3 | 1.5 |
| Cotton Section | 1.0 | 0.4 | 1.1 | 12.4 | 7.7 | 25.0 | 12.1 | 9.2 | 1.8 |
| Arid & Bad Land Areas (a) | 3.5 | 1.5 | 0.9 | 1.4 | 1.1 | 17.1 | 6.0 | 4.0 | 1.3 |
| Spring Wheat Section | 3.3 | 2.3 | 0.6 | (b) | (b) | 4.3 | 0.1 | 0.2 | 1.2 |
| Corn Section | 3.8 | 0.9 | 0.8 | (b) | (b) | 18.2 | 2.5 | 0.7 | 1.0 |
| Winter Wheat Section | 3.8 | 1.6 | 1.2 | 4.4 | 2.5 | 17.0 | 15.9 | 7.5 | 1.3 |
| Cotton Section | 1.3 | 0.6 | 1.3 | 3.5 | 1.4 | 18.8 | 28.1 | 10.7 | 1.1 |

(a) A large proportion of the acreage is irrigated.
(b) Less than 1-10 of one per cent.

Continued

REGION

| Tame Hay Percentage of | | Tame Hay Yield Per Acre Tons | Wild Hay Percentage of | | Wild Hay Yield Per Acre Tons | Cotton Percentage of | | Cotton Yield Per Acre Bales | All Other Crops Percentage of | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops | | Acreage of all Crops | Value of all Crops |
| 5.0 | 7.1 | 1.5 | 11.5 | 5.0 | 0.7 | 4.2 | 10.9 | 0.36 | 5.3 | 9.3 |
| 4.2 | 5.0 | 1.6 | 7.4 | 3.7 | 0.9 | 5.4 | 13.0 | 0.37 | 3.4 | 7.2 |
| 3.4 | 4.9 | 1.2 | 11.2 | 8.2 | 1.0 | | | | 5.8 | 11.6 |
| 7.4 | 9.2 | 1.7 | 11.6 | 5.2 | 0.9 | | | | 1.9 | 3.1 |
| 3.6 | 4.9 | 1.7 | 2.0 | 1.1 | 1.0 | 0.5 | 1.3 | 0.39 | 2.1 | 3.1 |
| 1.3 | 1.3 | 1.6 | 0.2 | 0.1 | 1.2 | 37.6 | 49.4 | 0.37 | 2.7 | 10.7 |
| 3.5 | 6.1 | 1.2 | 23.2 | 12.0 | 0.6 | 1.9 | 5.5 | 0.29 | 6.4 | 8.6 |
| 3.1 | 8.2 | 1.0 | 22.0 | 16.3 | 0.6 | | | | 9.4 | 10.2 |
| 4.7 | 6.9 | 1.4 | 34.7 | 17.0 | 0.7 | | | | 3.8 | 7.6 |
| 2.2 | 2.5 | 1.5 | 1.7 | 0.9 | 1.0 | 0.3 | 0.7 | 0.31 | 3.5 | 4.9 |
| 1.7 | 2.4 | 1.4 | 0.1 | (b) | 1.0 | 39.3 | 45.1 | 0.28 | 5.1 | 13.3 |
| 10.6 | 20.6 | 1.6 | 16.2 | 5.4 | 0.4 | 1.9 | 4.7 | 0.30 | 14.0 | 20.8 |
| 11.4 | 30.5 | 1.4 | 25.2 | 10.6 | 0.4 | | | | 15.8 | 23.5 |
| 14.0 | 20.5 | 1.9 | 3.6 | 1.9 | 0.8 | | | | 10.4 | 22.4 |
| 5.6 | 8.6 | 1.6 | 3.3 | 1.8 | 0.9 | 0.4 | 1.0 | 0.38 | 12.4 | 12.1 |
| 2.1 | 3.1 | 2.4 | 0.1 | 0.1 | 1.1 | 37.1 | 40.6 | 0.29 | 12.6 | 21.5 |
| 19.9 | 29.9 | 1.8 | 9.6 | 2.4 | 0.4 | 1.3 | 2.1 | 0.24 | 17.6 | 33.1 |
| 17.4 | 48.4 | 1.2 | 15.8 | 7.1 | 0.3 | | | | 18.9 | 12.8 |
| 22.7 | 21.2 | 2.2 | 3.1 | 0.7 | 0.6 | | | | 21.4 | 49.2 |
| 24.6 | 29.2 | 2.4 | 3.3 | 1.1 | 0.7 | 0.1 | 0.1 | 0.4 | 14.4 | 32.2 |
| 3.8 | 3.4 | 1.8 | 0.4 | 0.1 | 1.0 | 39.6 | 30.3 | 0.24 | 6.5 | 45.4 |

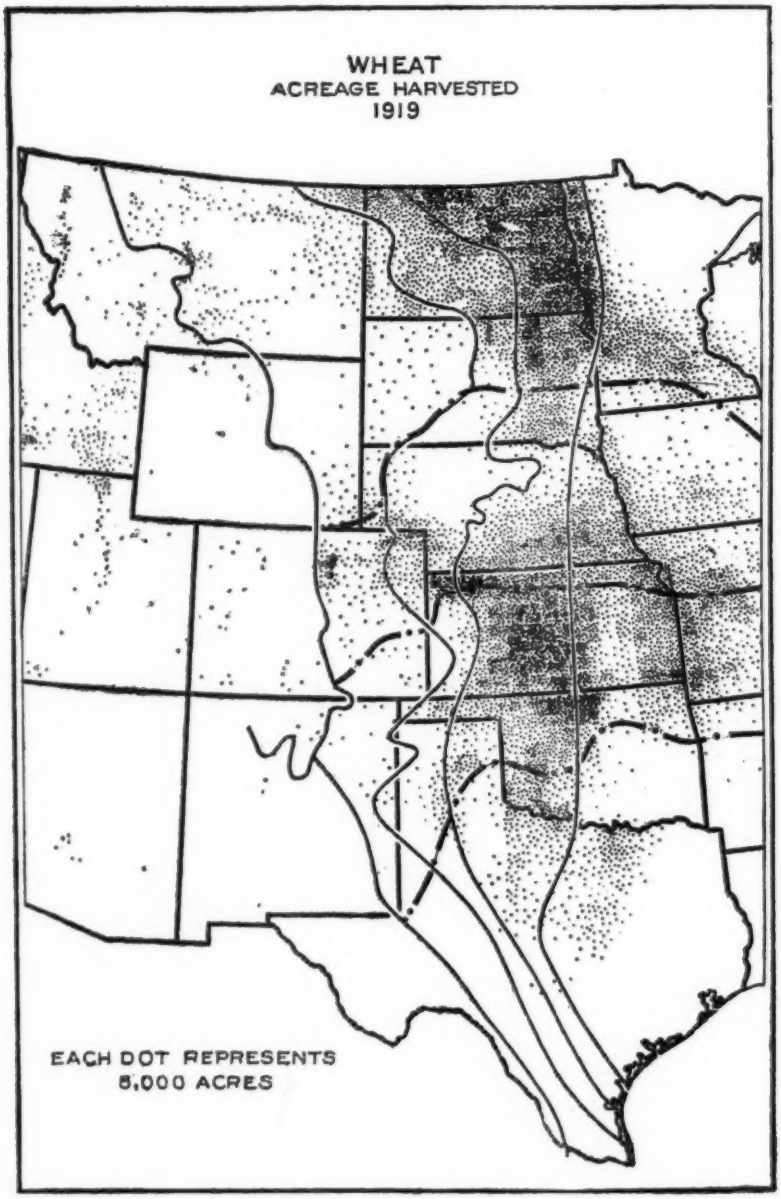



FIG. 5.—Distribution of Wheat Production.

The spring wheat section of the sub-humid Black-Earth belt contains nearly half of the acreage of spring wheat in the United States and 15 per cent more is found in the spring wheat section of the semi-arid Farming-grazing belt to the west. The winter wheat section of the Black-Earth belt contains about 30 per cent of the winter wheat acreage in the United States, and 4 per cent more is found in the Farming-grazing belt. The average yield of spring wheat per acre in the Black-Earth belt was 8 bushels in 1919, and in the Farming-grazing belt it was 5.2 bushels. The 10-year average yield per acre of spring wheat in the North Dakota portion of the Black-Earth belt is about 11 bushels, as compared with 9 bushels in the Farming-grazing belt. A small acreage of spring wheat is found in the Grazing-forage crop belt. The average yield of the acreage harvested in this belt in 1919 was 4.8 bushels, and over half the acreage planted was not harvested. The 10-year average yield per acre of spring wheat in the three North Dakota counties in this dry belt is 8 bushels, which is probably above the average for the belt. The ten-year average yield per acre of winter wheat in the Kansas portion of the Black-Earth belt is 11 bushels, of the Farming-grazing belt 8 bushels, and of the Grazing-forage crop belt 6 bushels.

These average yields in the semi-arid Farming-grazing and Grazing-forage crop belts of about 9 and 7 bushels, respectively, of spring wheat, and about 8 and 6 bushels per acre, respectively, of winter wheat, do not tell the whole story. The variations in acre-yield are perhaps of greater significance. Figure 6 shows the average yields of all varieties of spring wheat at the U. S. Department of Agriculture Experiment Stations at Dickinson, No. Dak., in the Farming-grazing belt, and at Bellefourche (Newell), So. Dak., in the Grazing-forage crop belt; also of winter wheat at Akron, Colo., on the western edge of the Farming-grazing belt and at Hays, Kan., in the Black-Earth belt. It will be noted that the acre yields at Bellefourche have ranged from nothing to nearly 60 bushels per acre, varying largely with the precipitation, and that at the other stations the variations in yield are very great. Droughts at critical times and severe attacks of rust, as well as deficient yearly precipitation, account for the low yields in several years.

The high yields obtained in the moist seasons 1914, 1915, and 1916 encouraged hosts of homesteaders to flow into these semi-arid grazing belts in the western portions of the Dakotas and in Montana, file their entries, build their shacks, break up 40 acres or more of the short-grass sod, and seed the land to wheat. Then the successive crop failures during the dry seasons 1917, 1918, and 1919 blasted their hopes and

drove many to the villages in the irrigated areas, or back home, leaving the fields to grow up to Russian thistles and other weeds. The permanent use of the land for crops seems to depend as much on the frequency and severity of the dry seasons as on the average yields obtained in a series of years, probably because several dry seasons exhaust the crop farmer's capital.

*Oats, Barley, Rye and Flax.*—Rye, barley, and flax are also impor-

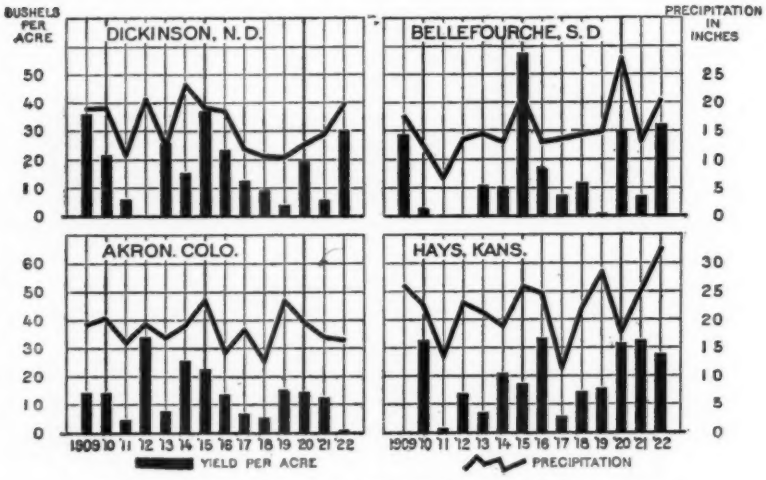



FIG. 6.—Yields in Relation to Precipitation at Selected Stations.

tant crops in the spring wheat section of the Great Plains, while oats are of greatest importance in the Corn Belt section (Fig. 7). Oats are grown, however, all the way from Canada to the Edwards Plateau, mostly in the Black-Earth belt. The oats and barley are grown mostly for local use as feed, and should be considered as part of a livestock rather than a grain system of farming.

The increase in rye acreage during the war years was rapid, owing to the high prices occasioned by the European demand, and also to the fact that rye is the only small grain crop in this northern area that can be planted in the fall, and thus relieve the heavy demand in the spring for labor, which was very scarce during the war. The acreage of barley decreased in the spring wheat section of the Great Plains between 1909 and 1919, but increased in the winter wheat section of Kansas and Oklahoma, probably owing in part to the labor situation and in part to the winter killing of winter wheat. Barley is a spring-sown crop. Nearly all the flax produced in the United

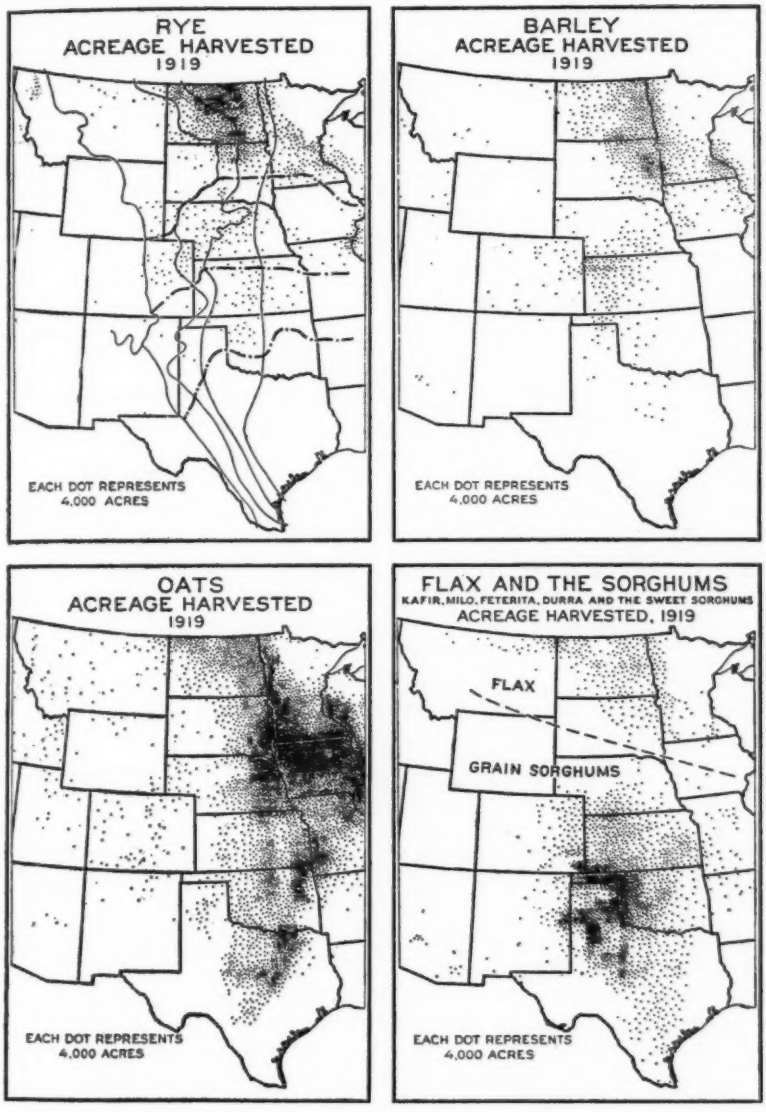



FIG. 7.—Distribution of Small Grains Other Than Wheat.

States is grown in the spring wheat section of the Great Plains, and the acreage decreased about 40 per cent between 1909 and 1919. Flax is a " new land " crop, owing largely to flax-wilt, a disease that persists in the soil for many years after infection. Much of the flax in the Black-Earth belt especially is now grown on newly broken rough or gravelly land, since there is little other virgin land in this section of the Great Plains.

*Corn and the Grain Sorghums.*—The second most important crop in the Great Plains region is corn, contributing about 14 per cent of the acreage and 16.5 per cent of the value of all crops. It is more important than wheat or hay in most of the Nebraska portion of the Black-Earth belt, in the southeastern corner of South Dakota, and in the northern tier of counties in Kansas; also in a band of counties extending entirely across the Plains portion of Colorado southwesterly from Kit Carson to Pueblo (Fig. 8.). It decreases somewhat in relative importance from east to west, occupying about 15 per cent of the crop land in the Black-Earth belt and about 10 per cent in the arid areas. Corn for grain, however, decreases from 13.6 per cent of the crop land in the Black-Earth belt to 6.9 per cent in the Arid Areas, whereas corn cut for forage increases from 1.8 per cent to 3.5 per cent. The average yields per acre of corn 1919-1922 in 7 counties in the Black-Earth section of Nebraska and Kansas was 25 bushels; in the Farming-grazing belt, 18 bushels; and in the Grazing-forage crop belt in Kansas, 16 bushels.

Very little corn is grown in North Dakota and Montana, except for forage or silage; and in southwestern Kansas, southeastern Colorado, western Oklahoma and Texas, and eastern New Mexico it is partially replaced by the sorghums, which are grown for both grain and forage (Fig. 7). In the winter wheat section of the Black-Earth belt the sorghums constitute 13 per cent of the crop land, and in the cotton section over 20 per cent. These percentages increase in the Farming-grazing belt to 47 per cent for the winter wheat and 26 per cent for the cotton section, and the percentages are almost the same for the corresponding sections of the Grazing-forage belt. The yields per acre both of grain and forage in 1919 were practically the same in these three moisture belts, but the yield of grain in the cotton section of each belt was much higher than in the winter wheat section.

These two crops, corn and the sorghums, are the most dependable crops in the Farming-grazing and Grazing-forage crop belts, and seem destined to become the dominant crops in a permanent system of agriculture in the northern and southern portions of these belts respectively.

*Hay.*—Hay is the third crop in value in the Great Plains region,

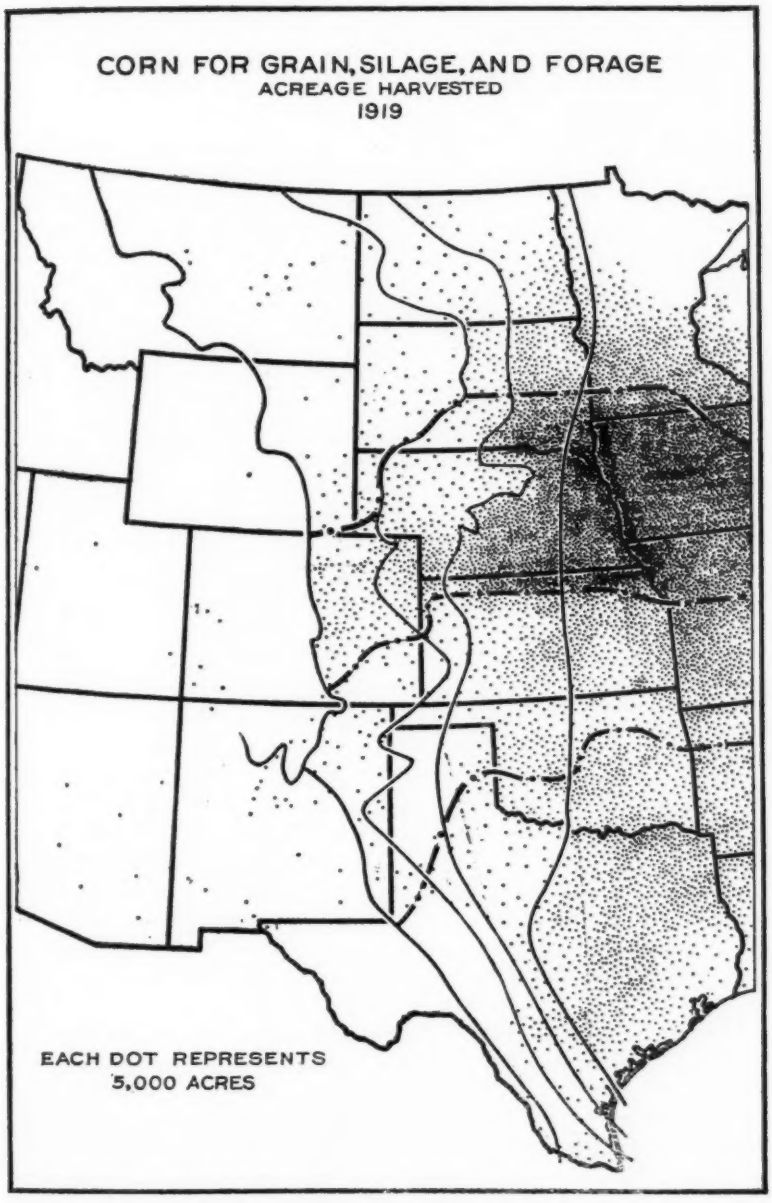



FIG. 8.—Distribution of Corn Production.

contributing about 16 per cent of the acreage, and 12 per cent of the value of all crops in 1919. In the Black-Earth belt hay constitutes 12 per cent of the acreage of all crops, and in both the Farming-grazing and Grazing-forage crop belts 27 per cent (Fig. 9).

Timothy and clover, the great hay crops of the eastern states north of the Cotton Belt, are unimportant in the Great Plains region. Timothy extends in thinly scattered fields about two-thirds across the Black-Earth belt in the Dakotas, just touches the eastern boundary of this belt in Nebraska, and does not reach it in Kansas. Red clover laps over the eastern margin of the Black-Earth belt only a few miles in the Dakotas and Nebraska, and peters out a hundred miles east of the belt in Kansas (Fig. 10).

The all important hay crop in the Dakotas and the Sand Hill area of Nebraska is wild hay, composed mostly of the native andropogons, locally called blue-stem, frequently mixed with wheat grass and needle grass (Fig. 10). In good seasons the acre yield of this hay in the sub-humid Black-Earth belt is almost equal to that of timothy in the humid East. This wild hay during the days of the cattlemen was practically the only crop secured in the Great Plains, and it has been the salvation of many of the homesteaders in the semi-arid belts in recent years. It is the principal feed, other than pasture, depended upon to keep the stock through the winter. Wild hay constitutes 7 per cent of the acreage of all crops in the Black-Earth belt, 23 per cent in the Farming-grazing belt, 16 per cent in the Grazing-forage belt, and less than 10 per cent in the arid and Badland areas.

In the southern Nebraska and Kansas portions of the Black-Earth belt alfalfa is the dominant hay crop (Fig. 10). This central section of the Black-Earth belt, and the land to the east as far as the Missouri river, includes the only large area of alfalfa in the United States grown under natural rainfall. The rainfall here is usually sufficient to produce fair yields of hay, but insufficient to leach the lime out of the sub-soil. Lime in the soil is essential to successful alfalfa culture.

Alfalfa is the principal haycrop also in the irrigated districts which are located mostly in the arid areas and in the Grazing-forage Crop belt.

Another important class of hay in this Great Plains region, especially in the Dakotas and Montana, and even more in Canada, consists of the small grains cut for hay. Frequently, wheat, barley, oats, or even rye may be sown for this purpose, but more commonly these fields are cut for hay when the crop is not worth harvesting for grain. In 1919, which was one of the driest years ever known in the northern plains, an unusually large acreage of grain was cut for hay (Fig. 10).

FIG. 9.—Distribution of Hay Production.

Brome grass and sweet clover are relatively new hay crops of promise in the Great Plains region, especially in the spring wheat section. Although the acreage of both crops is small, it is increasing rapidly.

*Cotton.*—Only one other crop need be mentioned in this brief survey, namely, cotton, which constituted nearly half the value of all crops in the cotton section of the Black-Earth belt in 1919, and over 40 per cent in the cotton section of both the semi-arid belts (Fig. 11). Cotton has been pressing west and northwest until it has now climbed onto the Staked Plains of the Texas Panhandle, and is grown almost as far northwest as Amarillo. The winters on these plains are severe, and there is also no forest and little trash about the farms for the boll weevil to hibernate in, so that in this respect the Great Plains possess an advantage over other parts of the South. But under the dry conditions the plants are small and the yields are low, and a profit can be obtained only by an extensive type of culture and greater use of machinery than is common in the Cotton Belt proper.

Cotton is becoming the leading crop in the southeastern portion of the Staked Plains, on the Red Prairies, along the eastern margin of the Edwards Plateau, and throughout the Gulf Coastal Plain area. There is a large area of land in these districts that may be put into cotton if the price remains high enough to compensate for the usually low acre-yields. Should this occur, the southern Plains, instead of being the most sparsely, would become the most densely populated portion of the Great Plains region.

*The Farm Garden.*—In this connection the importance of the farm garden and other farm contributions to the family living should be noted. In 1919 the average value of vegetables grown for home use only, including potatoes, was $78 per farm in Montana, $67 in North Dakota, $66 in South Dakota, $58 in Nebraska, $52 in Kansas, $62 in Oklahoma and $60 in Texas. This is considerably less than in New England and the North Atlantic States, but almost equal to the average for the United States. A farm survey in North Dakota shows that in 1921 on 123 farms scattered throughout the state the average value of the food furnished the family by the farm was $524, whereas groceries bought amounted to $296. The value of the potatoes and vegetables furnished by the farm was $68, poultry $81, pork $63, beef $33, while dairy products, amounting to $267, were almost half the total.*

* "Cost of Production and Farm Organization on 123 Farms," by Willard, Metzger and Thorfinnson, North Dakota Agricultural Experiment Station, Bulletin 165, page 97. This bulletin presents very valuable data on agriculture in the Spring Wheat Section of the Great Plains.

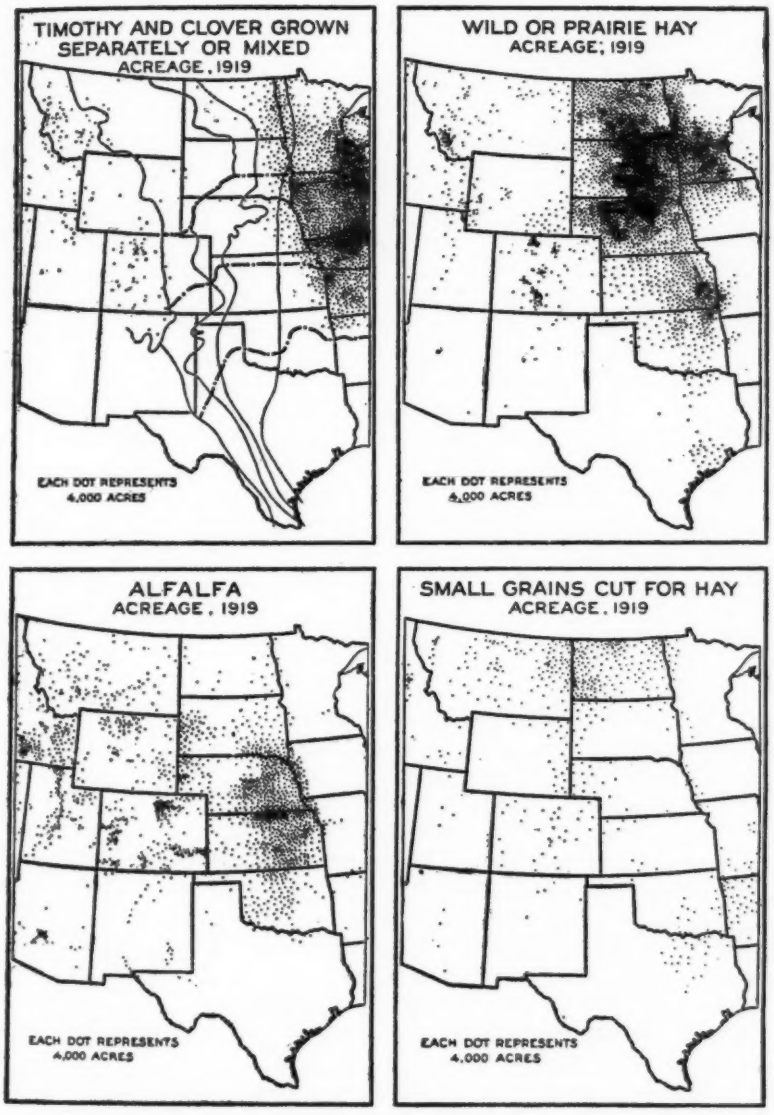



FIG. 10.—Distribution of Four Important Hay Crops.

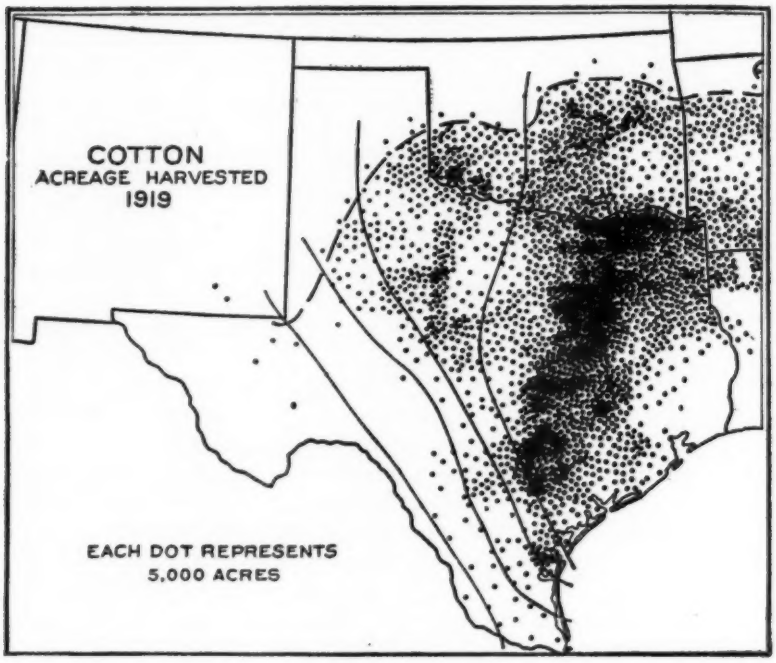



FIG. 11.—Distribution of Cotton Acreage.

Probably one of the principal reasons why European immigrants appear more successful as settlers than native Americans in the semi-arid belts especially, and seem better able to survive the periods of drought, is because of their gardens, which are made to contribute a large part of the family living. Many of the native American farmers seem to inherit, in a measure, the cattleman's dislike of hand labor, especially gardening, which seems to him a petty affair unworthy of his time. The large wheat farmer also has little time for gardening in the spring when putting in his wheat. But as farming in the Great Plains becomes less specialized and the seasonal needs of labor more uniform, greater attention will undoubtedly be given to the farm garden and the livestock which contribute directly to the family living.

PASTURE IN THE GREAT PLAINS.—In the Black-Earth belt about 31 per cent of the land area is used only for pasture, as compared with 45 per cent in crops, but the annual rental value per acre of the pasture probably does not exceed a third that of the crop land. In the Farming-

grazing belt about 60 per cent of the land area is in pasture, and 21 per cent in crops; while in the Grazing-forage crop belt about 75 per cent is in pasture and 7 per cent is in crops. The rental value of the pasture in these belts is perhaps one-fourth and one-fifth, respectively, that of the crop land. Multiplying the acreage by the average rental value per acre it appears that the aggregate rental value of the pasture land in the Black-Earth belt is less than one-fourth that of the crop land, and in the Farming-grazing belt about three-fourths. In the Grazing-forage crop belt, excluding the irrigated land, the annual aggregate rental value of the pasture land is twice that of the crop land.

*Composition of the Pasture.*—In the Black-Earth belt the pasture is composed mostly of timothy and the wild prairie grasses in the eastern portion of the spring wheat section; brome grass and the wild grasses, mostly needle grass, wheat grass and blue-stem, in the western portion. In the corn section of the Black-Earth belt Kentucky blue-grass becomes an important pasture grass, and in the eastern portion of the belt in Nebraska it is the dominant grass. In Kansas it recedes eastward and is replaced by alfalfa and wild prairie grass in the northern portion of the state, while in the southern portion practically all the pasture is composed of the native grasses, mostly buffalo grass, blue-stem, and bunch grass. In Texas mesquite grass displaces buffalo grass from Amarillo southward. Johnson grass is also used for pasture in the eastern portion of the Black-Earth belt in Texas and Oklahoma, and Sudan grass in the western portion.

In the semi-arid Farming-grazing and Grazing-forage crop belts the pasture is composed almost wholly of the native grasses. Grama grass, wheat grass, and needle grass are most important in Montana, Wyoming and the Dakotas, buffalo grass and grama grass in Nebraska, Kansas and Colorado, with bunch grass (andropogons) on the sandy soils; and in Texas mesquite grass becomes dominant.

*Carrying Capacity of the Pasture.*—The carrying capacity of the wild grass pasture in the Black-Earth belt ranges, in general, from 1½ to 4 acres per cow or steer in the spring wheat area, and from 3 to 15 acres in the winter wheat area, but on the Edwards Plateau and Gulf Coastal Plain portions of this Black-Earth belt it diminishes to 15 to 20 acres per cow or steer (Fig. 12). In the Farming-grazing belt from 5 to 15 acres are required in the Dakota, Nebraska, and Kansas portions, but from 15 to 25 acres in the Texas portion; and in the Grazing-forage crop belt from 15 to 25 acres throughout. In the arid grazing areas 20 to 40 acres per cow or steer are usually needed. In these arid districts, however, sheep probably graze a greater acreage than cattle.

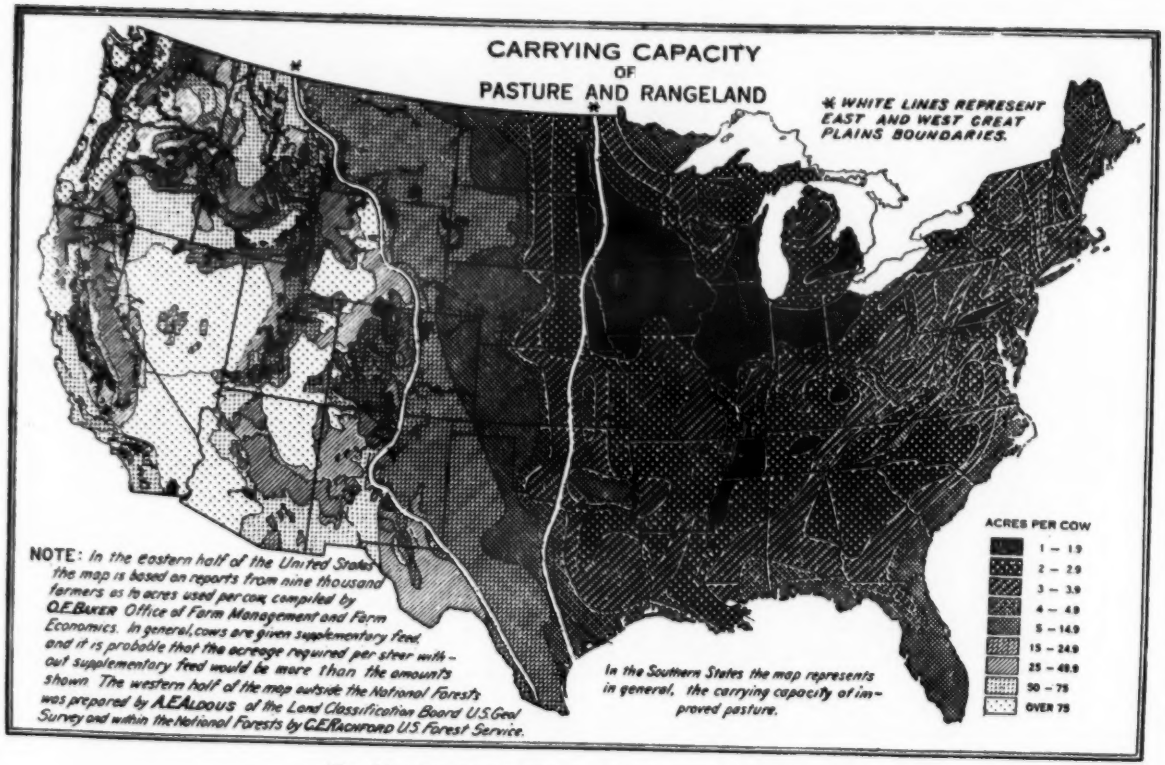

CARRYING CAPACITY
OF
PASTURE AND RANGELAND
* WHITE LINES REPRESENT EAST AND WEST GREAT PLAINS BOUNDARIES.
ACRES PER COW
1 – 1.9
2 – 2.9
3 – 3.9
4 – 4.9
5 – 14.9
15 – 24.9
25 – 49.9
50 – 75
OVER 75
In the Southern States the map represents in general, the carrying capacity of improved pasture.
NOTE: In the eastern half of the United States the map is based on reports from nine thousand farmers as to acres used per cow, compiled by O.E. BAKER Office of Farm Management and Farm Economics. In general, cows are given supplementary feed, and it is probable that the acreage required per steer without supplementary feed would be more than the amounts shown. The western half of the map outside the National Forests was prepared by A.E. ALDOUS of the Land Classification Board U.S. Geol Survey and within the National Forests by C.E. RACHFORD U.S. Forest Service.

FIG. 12.—Carrying Capacity of Pasture and Range Land.

The decrease in carrying capacity of the pasture from north to south within the same moisture belt should be noted. Soil color and crop yields show close correlation, but carrying capacity of pasture diminishes more rapidly than crop yields with increase in temperature along lines of equal rainfall. For instance, the line of 15 acres per cow carrying capacity crosses the Canadian boundary near Opheim, Mont., where the average annual precipitation is about 14 inches, and ends at Corpus Christi, Tex., on the Gulf of Mexico, where the annual precipitation is 25 inches, crossing both the Farming-grazing and the Black-Earth belts (compare Fig. 12 with Fig. 1). Probably the seasonal distribution of rainfall, especially the summer drought in southern Texas, is an important factor.

Live Stock in the Great Plains.—The Great Plains were originally the feeding grounds of vast herds of buffalo. During the last third of the nineteenth century the buffalo were replaced by cattle, and today cattle raising remains the dominant agricultural enterprise in the semi-arid portions of the Plains. The Black-Earth belt, except the Corn Belt portion, has become and will continue to be for some years primarily a cash crop country, and probably the value of the wheat and other cash crops in the Farming-grazing belt will equal the value of the annual production of live stock and live stock products for several years. But in the Grazing-forage crop belt and in the non-irrigated portions of the arid areas live stock production will undoubtedly remain the principal industry. The density of distribution of live stock, on the basis both of animal units and of value per square mile, and the relative importance of the different classes of live stock, are shown for the four belts in Table II.

It will be noted that in the Black-Earth belt the number of animal units per square mile varied from 85 in the corn section to 40 in the cotton section, with an average density for the belt of 54 per square mile. In the Farming-grazing belt the number per square mile varied from 37 in the corn section to 30 in the winter wheat section, and averaged 33 for the entire belt. In the Grazing-forage crop belt the greatest density, 38 per square mile, was likewise in the corn section, which contains considerable irrigated land, and the least, 21 per square mile, in the spring wheat section, the average for the belt being 24 per square mile. In the Arid and Badlands areas, including irrigated districts, the average number of animal units per square mile was 22. This is nearly 30 acres per animal unit, as compared with about 8 acres in the corn section of the Black-Earth belt.*

* An animal unit equals 1 horse, 1 cow or steer, 5 swine, 7 sheep and 100 poultry.

TABLE

GREAT PLAINS

LIVESTOCK DENSITY AND

| | Number of Animal Units (3) | Number of Animal Units Per. Sq. Mile | Value of Live-stock Per. Sq. Mile | Beef Cattle Percentage of | | Dairy Cattle Percentage of | |
|---|---|---|---|---|---|---|---|
| | | | | Total Animal Units | Total Live-stock Value | Total Animal Units | Total Live-stock Value |
| Great Plains Total..... | 22,628,119 | 36 | 2280 | 50.3 | 41.7 | 14.0 | 11.7 |
| Black-Earth Belt..... | 11,257,536 | 54 | 3535 | 43.4 | 32.8 | 18.3 | 14.3 |
| Spring Wheat Section.. | 2,485,351 | 45 | 3109 | 28.4 | 19.7 | 27.4 | 20.8 |
| Corn Section..... | 3,461,276 | 85 | 5582 | 43.2 | 31.6 | 16.1 | 12.8 |
| Winter Wheat Section.. | 3,020,394 | 52 | 3306 | 49.3 | 39.2 | 15.6 | 12.5 |
| Cotton Section..... | 2,290,515 | 40 | 2710 | 52.0 | 41.1 | 15.4 | 11.6 |
| Farming-Grazing Belt.... | 5,097,132 | 33 | 1965 | 57.0 | 50.9 | 11.0 | 9.9 |
| Spring Wheat Section.. | 1,651,401 | 31 | 1847 | 41.0 | 34.5 | 19.5 | 17.1 |
| Corn Section..... | 1,901,471 | 37 | 2046 | 63.8 | 58.5 | 7.4 | 7.1 |
| Winter Wheat Section.. | 808,056 | 30 | 1855 | 71.0 | 63.4 | 7.1 | 6.2 |
| Cotton Section..... | 736,204 | 34 | 2201 | 60.3 | 55.5 | 6.0 | 5.0 |
| Grazing-Forage Crop Belt. | 3,796,701 | 24 | 1513 | 56.7 | 50.8 | 9.3 | 8.9 |
| Spring Wheat Section.. | 2,020,366 | 21 | 1333 | 52.5 | 47.6 | 9.0 | 8.6 |
| Corn Section (3)..... | 592,065 | 38 | 2373 | 49.9 | 42.9 | 18.6 | 17.5 |
| Winter Wheat..... | 749,478 | 23 | 1324 | 74.4 | 69.6 | 5.3 | 5.1 |
| Cotton Section (3)..... | 434,792 | 34 | 2289 | 55.3 | 47.0 | 4.9 | 5.0 |
| Arid & Bad Land Areas(3) | 2,476,748 | 22 | 1410 | 58.1 | 52.6 | 7.2 | 6.9 |
| Spring Wheat Section.. | 1,144,243 | 19 | 1193 | 52.7 | 47.6 | 7.3 | 7.2 |
| Corn Section..... | 207,964 | 52 | 3837 | 35.2 | 32.6 | 16.2 | 13.2 |
| Winter Wheat Section... | 649,582 | 25 | 1461 | 64.4 | 58.2 | 8.7 | 8.6 |
| Cotton Section..... | 474,959 | 25 | 1529 | 72.7 | 68.7 | 1.0 | 0.9 |

(1) An animal unit equals one horse, mule, cow or steer, five swine, seven sheep or goats, underrates swine, sheep, goats and poultry in this region.

(2) Less than one-tenth of one per cent.

(3) Includes irrigated land.

II

REGION

RELATIVE IMPORTANCE

| Horses and Mules Percentage of | | Sheep Percentage of | | Goats Percentage of | | Swine Percentage of | | Poultry Percentage of | |
|---|---|---|---|---|---|---|---|---|---|
| Total Animal Units | Total Live-stock Value | Total Animal Units | Total Live-stock Value | Total Animal Units | Total Live-stock Value | Total Animal Units | Total Live-stock Value | Total Animal Units | Total Live-stock Value |
| 23.4 | 29.5 | 4.3 | 5.6 | 0.8 | 0.6 | 5.4 | 8.3 | 1.8 | 2.4 |
| 25.8 | 35.1 | 1.5 | 1.8 | 0.3 | 0.1 | 8.0 | 12.2 | 2.6 | 3.4 |
| 32.6 | 42.9 | 2.2 | 2.7 | (2) | (2) | 7.0 | 11.0 | 2.3 | 2.8 |
| 22.0 | 26.9 | 1.3 | 1.6 | (2) | (2) | 14.7 | 23.4 | 2.8 | 3.5 |
| 27.3 | 37.7 | 0.6 | 0.7 | 0.1 | (2) | 4.4 | 5.4 | 2.8 | 4.0 |
| 22.8 | 35.6 | 2.1 | 2.4 | 1.2 | 0.7 | 4.1 | 5.1 | 2.2 | 3.1 |
| 22.3 | 25.5 | 2.9 | 4.1 | 1.5 | 1.1 | 4.1 | 6.4 | 1.2 | 1.8 |
| 30.9 | 36.6 | 3.1 | 4.1 | (2) | (2) | 4.1 | 6.1 | 1.4 | 1.9 |
| 21.2 | 21.2 | 0.8 | 1.1 | (2) | (2) | 5.7 | 9.9 | 1.2 | 1.9 |
| 17.2 | 23.1 | 1.5 | 1.9 | (2) | (2) | 2.1 | 3.3 | 1.1 | 1.8 |
| 11.4 | 15.1 | 9.3 | 13.3 | 10.1 | 6.9 | 2.1 | 2.6 | 0.7 | 1.1 |
| 20.8 | 23.1 | 9.0 | 12.2 | 1.4 | 1.0 | 1.9 | 2.6 | 0.8 | 1.3 |
| 26.8 | 28.0 | 9.2 | 12.2 | (2) | (2) | 1.7 | 2.3 | 0.8 | 1.2 |
| 17.1 | 21.2 | 9.5 | 10.8 | (2) | (2) | 3.4 | 5.0 | 1.4 | 2.2 |
| 13.7 | 16.8 | 4.1 | 4.9 | 0.4 | 0.2 | 1.3 | 2.1 | 0.7 | 1.1 |
| 10.3 | 12.9 | 16.1 | 24.5 | 11.4 | 7.7 | 1.4 | 1.7 | 0.6 | 1.0 |
| 18.7 | 20.1 | 12.4 | 16.4 | 1.4 | 0.9 | 1.5 | 1.9 | 0.7 | 1.0 |
| 25.9 | 25.1 | 12.2 | 17.6 | (2) | (2) | 1.3 | 1.6 | 0.6 | 1.0 |
| 21.3 | 27.4 | 22.3 | 21.0 | (2) | (2) | 3.6 | 3.7 | 1.4 | 1.8 |
| 15.1 | 19.0 | 8.4 | 9.3 | 0.4 | 0.2 | 2.0 | 3.0 | 0.8 | 1.4 |
| 5.0 | 4.8 | 13.8 | 20.2 | 7.0 | 4.6 | 0.4 | 0.4 | 0.1 | 0.2 |

and 100 poultry. This customary ratio is based on feed requirements in the east and probably

*Cattle.*—In 1920 cattle constituted 64 per cent of the total animal units in the Great Plains region, and 53 per cent of the value of all livestock. Beef cattle were more important than dairy cattle in all portions of the region, except in the spring wheat section of the Black-Earth belt, where the two classes of cattle were of equal importance (compare Figs. 13 and 14). Beef cattle constituted half of the total animal units in the Great Plains region as a whole, whereas dairy cattle contributed only 14 per cent of the animal units. Dairy cattle decrease and beef cattle increase in relative importance from north to south. The exception to this statement to be noted in the corn sections of the Grazing-forage crop belt and of the Arid Areas (see table II) is occasioned by the irrigated districts of the South Platte Valley. The intensive cultivation and the abundant feed in these irrigated districts, especially alfalfa and beet pulp, favor the development of dairying But even in these irrigated districts beef cattle are more important than dairy cattle.

Many of the cattle raised on the Great Plains are sent to the Corn belt for fattening, often for further growth also. Such cattle are known as feeders and stockers. Corn is abundant and cheap in the corn belt, whereas pasture is abundant and cheap on the Plains, and pasture is especially adapted to growing stock. Thus these two regions supplement each other, and contribute considerably over half of the beef consumed in the United States. The Great Plains region had, on January 1, 1920, over one-third of the beef cattle in the United States (Fig. 13).

Dairying is slowly developing in the Great Plains region, particularly in the moister Black-Earth belt, and in the spring wheat section of this belt it seems not unlikely that it will eventually replace wheat as the leading farm enterprise (Fig. 14). At a few places in the Farming-grazing belt dairying has also been successful, but in this belt, and especially in the Grazing-forage crop belt, the large acreage of pasture required to carry a cow makes dairying difficult except as a minor farm enterprise.

*Horses and Mules.*—Horses are raised and used throughout the Great Plains for farm power and transport purposes. A considerable number of colts also are raised, especially in the Northern Plains, for shipment to the eastern horse markets. Horses, like beef cattle, can be raised perhaps more cheaply on the pasture of the Great Plains than anywhere else in the United States (Fig. 15).

Horses are needed in the cropped portions of the Great Plains for plowing, seeding, and harvesting, and in the grazing belts for the ranchers and cowboys to ride; hence, horses are more evenly dis-

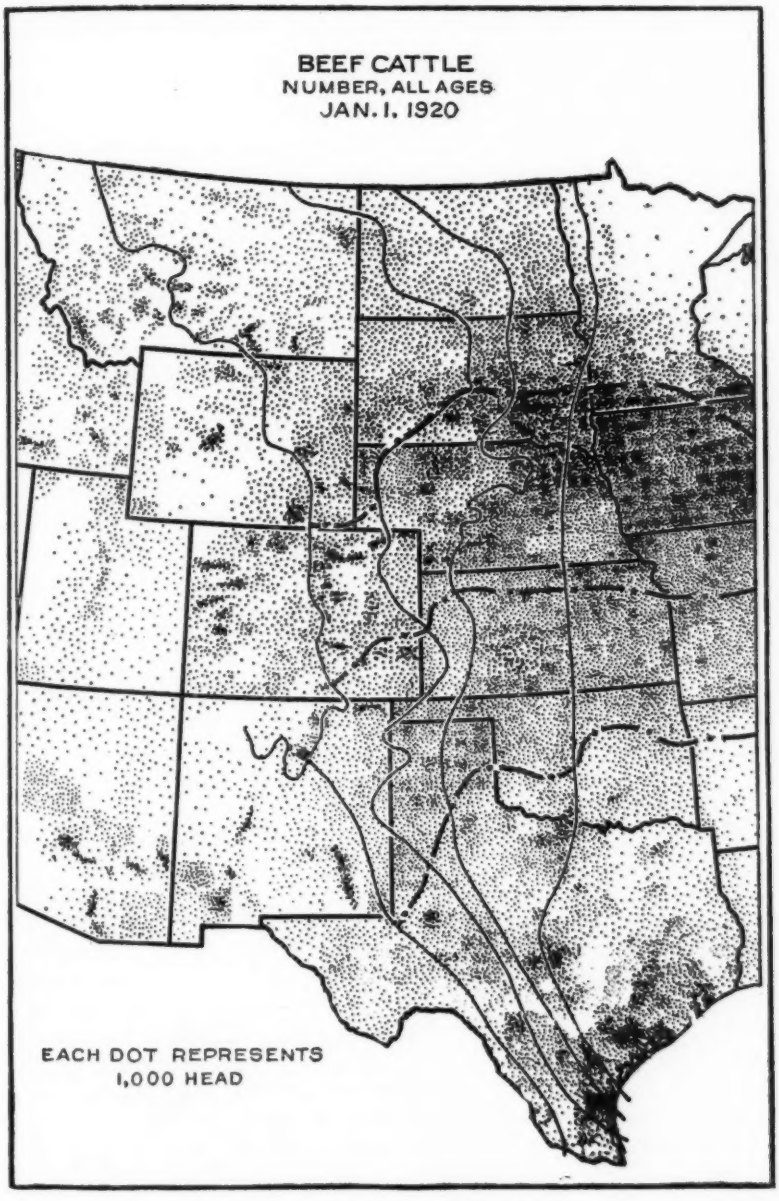



FIG. 13.—Distribution of Beef Cattle.

tributed over the plains than any other class of livestock. In the Southern Plains mules are almost as numerous as horses, but in the Northern Plains there are very few mules (Fig. 15). Horses and mules constitute nearly one-fourth of the total animal units in this region, nowhere exceeding one-third nor falling below one-tenth, except in the cotton section of the arid areas.

*Sheep.*—Sheep raising is locally an important industry in the Great Plains. Most of the sheep are located in the arid districts along the Milk, Missouri, Musselshell and Yellowstone rivers in Montana, along the Little Missouri breaks and other rough lands in northwestern South Dakota, on the poorer semi-arid lands of northeastern Wyoming, in the North and South Platte Valleys of southeastern Wyoming and northeastern Colorado, in the Pecos Valley of New Mexico, and on the Edwards Plateau of Texas (Fig. 15). Because of their cleft lip, sheep can graze shorter grass than cattle, and needing less water, are better adapted than cattle to arid lands.

It is interesting to note that sheep constitute 1.5 per cent of the total annual units in the Black-Earth belt, 2.9 per cent in the Farming-grazing belt, 9 per cent in the Grazing-forage crop belt, and over 12 per cent in the Arid and Badlands areas. The sheep, except in Texas, are usually handled in flocks of 1000 to 1500, in charge of a shepherd, and roam across these arid or semi-arid lands ever seeking fresh pastures. In that portion of the Plains adjacent to the Rocky Mountains, most of the sheep graze in the summer in the National Forests, usually above timber line, and before the first snows are brought down into the valleys or deserts for the winter. In Texas, where most of the land has been in private ownership for years, much of the range is fenced with wolf proof wire. Allowing the sheep to graze freely avoids much of the tramping of the vegetation by the moving flock and almost doubles the carrying capacity of the range.

If the present price of wool continues it seems not unlikely that the sheep industry in the West will expand considerably. The world's population is increasing at the rate of about 20 million a year and the waste lands are being occupied. As the world fills up with people it seems almost inevitable that the price of both wool and meat will rise, and as sheep supply mutton as well as wool, the future of the sheep industry in the western states seems assured. Moreover, as the United States imports a large part of the wool it consumes, the prosperity of the industry can be facilitated by import tariffs.

*Hogs.*—Hogs are of importance only in the Black-Earth belt, and in this belt are of great significance only in eastern South Dakota and Nebraska, and in northern Kansas, in other words, only in that portion

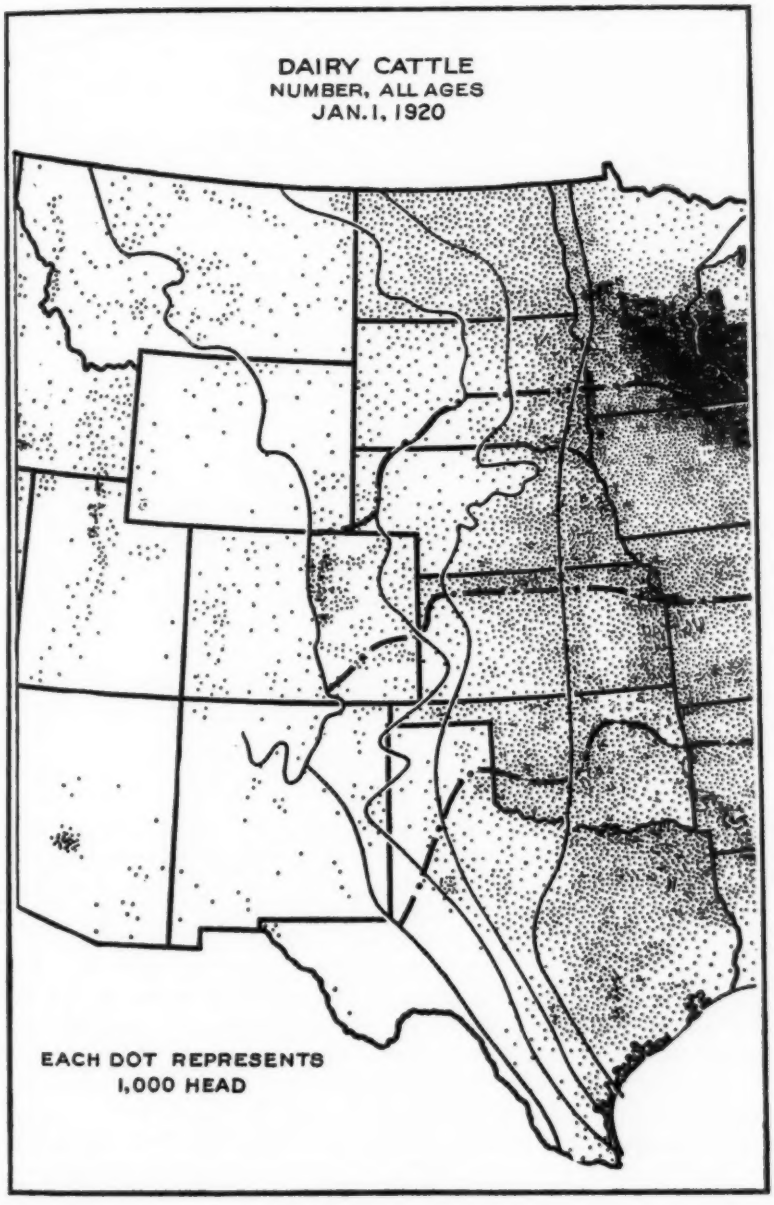



FIG. 14.—Distribution of Dairy Cattle.

of this belt where corn is the dominant crop (Figs. 8 and 15). They constitute about 15 per cent of the total animal units in this corn section of the Black-Earth belt, and 8 per cent in the Black-Earth belt as a whole, whereas in the Farming-grazing belt they constitute 4.1 per cent of the animal units, in the Grazing-forage crop belt 1.9 per cent and in the Arid and Badland areas 1.5 per cent. Hogs require concentrated feed, such as grain and alfalfa, and would starve on short grass pasture on which cattle thrive. Hogs, therefore, are produced in the semi-arid belts outside the irrigated districts only in small numbers and mostly for home use. For this purpose two or three hogs, fed in part on refuse grain, can often be kept with profit, primarily because the farmer can save paying the consumer's price for meat, which is frequently two or three times the producer's price.

Agricultural Productivity.—Statistics of average value of agricultural products per acre are not available for a series of years, but Fig. 16 presents a rough approximation to such figures. It is based on the value of the crops produced in 1919 plus one-fourth the value of the live stock on January 1, 1920. The year 1919 was one of the driest ever known in North Dakota and Montana; hence, this map does injustice to these states. A similar map for 1909 is provided, therefore, even though it also fails to do justice to the western Dakotas and Montana, since settlement of the dry-farming lands had scarcely begun at that time.

*Productivity of the Moisture Belts.*— Along the eastern boundary of the Black-Earth belt the average gross value of agricultural products per acre of land area ranged in 1919 from about $25 in southeastern South Dakota and northeastern Nebraska to about $10 in Texas, where much of the land is too rough for crop production. In North Dakota and Texas the western boundary of the Black-Earth belt corresponds rather closely with the $7.00 per acre productivity line, but in South Dakota, Nebraska, and northern Kansas, it is close to the $10 per acre line. This discrepancy is due in large measure to the exceptionally dry season in North Dakota, and in Texas to the fact that the western boundary of the Black-Earth belt is drawn without regard to local topographic conditions. The eastward dip of the $10 line in the southern portion of the Texas Panhandle and along the Kansas-Oklahoma boundary, is owing almost wholly to large areas of rough topography, which preclude in part the cultivation of crops.

The western boundary of the Farming-grazing belt similarly follows quite closely, except in northeastern Colorado, the line of $2.00 per acre productivity in 1919; and the western boundary of the Grazing-forage crop corresponds in general to the line of $1.00 per acre productivity.

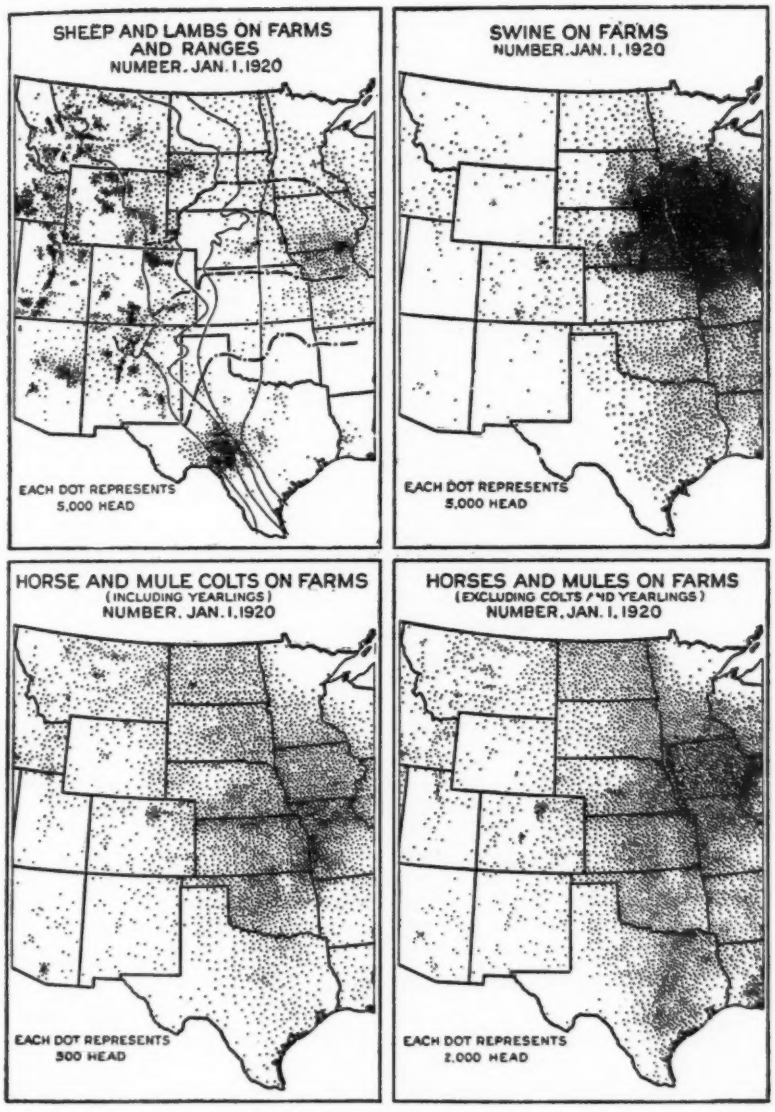

SHEEP AND LAMBS ON FARMS AND RANGES
NUMBER. JAN. 1, 1920
EACH DOT REPRESENTS 5,000 HEAD
SWINE ON FARMS
NUMBER. JAN. 1, 1920
EACH DOT REPRESENTS 5,000 HEAD
HORSE AND MULE COLTS ON FARMS
(INCLUDING YEARLINGS)
NUMBER. JAN. 1, 1920
EACH DOT REPRESENTS 500 HEAD
HORSES AND MULES ON FARMS
(EXCLUDING COLTS AND YEARLINGS)
NUMBER. JAN. 1, 1920
EACH DOT REPRESENTS 2,000 HEAD

FIG. 15.—Distribution of Sheep, Swine, Horses and Mules.

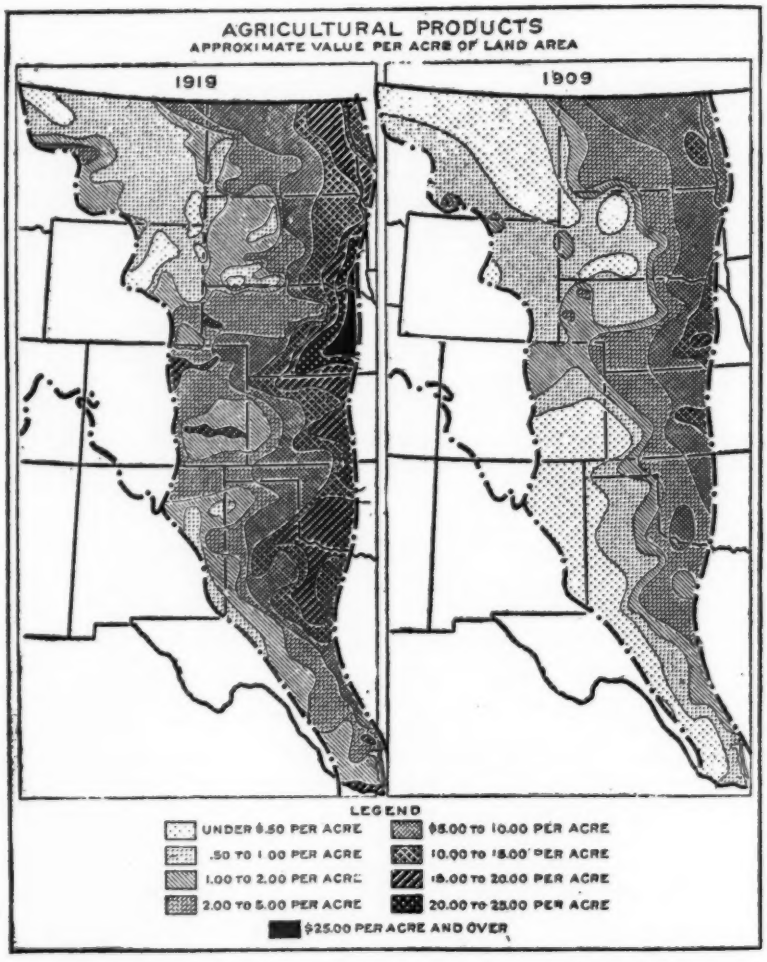

AGRICULTURAL PRODUCTS
APPROXIMATE VALUE PER ACRE OF LAND AREA
1919
1909
LEGEND
UNDER $.50 PER ACRE
.50 TO 1.00 PER ACRE
1.00 TO 2.00 PER ACRE
2.00 TO 5.00 PER ACRE
$5.00 TO 10.00 PER ACRE
10.00 TO 15.00 PER ACRE
15.00 TO 20.00 PER ACRE
20.00 TO 25.00 PER ACRE
$25.00 PER ACRE AND OVER

FIG. 16.—Value of Agricultural Products Per Acre 1909 and 1919.

The arid areas have values of agricultural products of less than $1.00 per acre, except where partly irrigated, as in the Arkansas and South Platte valleys of Colorado, in which case the average productivity rises to over $15 per acre. The lowest productivity—less than 50 cents per acre—is found in that portion of the central Wyoming desert included within the Great Plains, and in the driest section of north central Montana, around Shelby and Chester. Fifty

cents, however, is an abnormally low productivity for this Montana district; one to two dollars is probably about normal. Much of the land in the vicinity of these towns was plowed and seeded during the wet years 1914, 1915 and 1916. The yields were high and improved farms sold for $30 and even $40 an acre. Yet climatic records show an average annual precipitation of only 12 and 10 inches, respectively. In 1919 almost any of this land could have been bought for $10 an acre. Towns, schools, roads, many of the farm buildings, —in brief, the entire system of civilization, achieved mostly on borrowed capital, has been built upon a $5 to $10 per acre instead of a $1.00 to $2.00 per acre gross productivity.

The notable increase in value of agricultural products per acre between 1909 and 1919 should be noted. This, of course, is owing in large part to the much higher prices of agricultural products in 1919, but also in part to progress in agricultural development. The $5.00 per acre productivity line followed closely in 1909 the western boundary of the Black-Earth belt across the Dakotas and Nebraska; but in the southern plains the productivity per acre along this western boundary of the Black-Earth belt was only about $1.00 per acre. The gross productivity of the land along this boundary in the northern plains, therefore, about doubled during the decade, as measured in dollars; whereas, in the southern plains it increased, on the average, about five-fold.

*Factors Affecting Productivity.*—Although the climatic, topographic and soil conditions are the primary factors in determining the productivity of land in the Great Plains region, scarcely less important at present are distance from railroad and good public highways. The writer recalls in a recent auto trip across the level plains of western Kansas that distance from a railroad station could be estimated closely by noting the proportion of the land in crops. Six or seven miles from a town all the land was usually in native pasture. At about five miles an occasional field of wheat appeared, at four miles perhaps one-fourth of the land was in wheat, corn, or grain sorghum, at two miles apparently about half the land was in crops, and close to town nearly all the land.

Apparently, the cost of hauling wheat to the elevator was such that at the prices prevailing it did not pay, under the semi-arid conditions in this district, to raise wheat more than six or seven miles from a railroad. As the roads improve this distance will doubtless increase. A sharp rise in the price of wheat would have the same effect, and would cause the breaking up and seeding to wheat of thousands of acres of pasture land. Also, where the rain fall is heavier and the acre-yield

higher, it pays to haul wheat a greater distance, other factors remaining equal. Much of the wheat in the Farming-grazing belt is grown ten to fifteen miles from an elevator. Cases are known to the writer in which wheat has been hauled 60 miles to a railroad.

Figure 17 shows the areas of land in the Great Plains distant more than 5 miles, more than 15 miles, and more than 25 miles from a railroad. It will be noted that along the eastern edge of the Black-Earth belt most of the land is within five miles of a railroad, whereas in the Grazing-forage crop belt there are several large areas of land which are more than 25 miles from a railroad.

Size of Farms.—Throughout the Great Plains, as in all parts of the United States, the trend is toward the family size farm. No corporate or other form of large-scale agricultural operations can compete permanently, it would appear, with the individual farmer, who knows nothing of 8-hour days, possesses the stimulus afforded by private initiative, and works for a much smaller compensation than that received by urban labor.

*Value of Products, not Acreage, the Measure of Size.*—The size of farms in the Great Plains, even more than in most parts of the United States, must be measured by productivity and not by acreage. Farm surveys in Nebraska have shown that 640 acres, or one section of land, in the western portion of the state yield products of no greater value, on the average, than 160 acres, a quarter section, in eastern Nebraska. In 1919 the average gross value of products per farm (value of crops plus one-fourth value of live stock) was about $4,000 in both eastern and western Nebraska. In many of the counties of Montana, which contain both live stock ranches and dry land farms, the gross productivity per farm in this dry year averaged less than $500, the lowest, in Liberty County, being only about $200. In Sutton County, Texas, on the other hand, where the farms (ranches) average over 8,000 acres in area, the gross value of products in 1919 was about $12,000 per farm. These are the extremes, the average in this year in well-settled farming communities being about $4,000 to $5,000, and the tendency is toward a farm area yielding products of this gross value. This means 5,000 to 6,000 acres of land at 80 cents per acre productivity, such as is found along the arid margin of the Grazing-forage crop belt, or 500 to 600 acres of 8 dollar productivity land, which acreage and productivity characterized the semi-arid margin of the Black-Earth belt. With normal prices of farm products and normal costs of production the gross value of products per farm and per acre would probably be only about two-thirds this amount. The important fact to note is that the size of the farm in the Great Plains

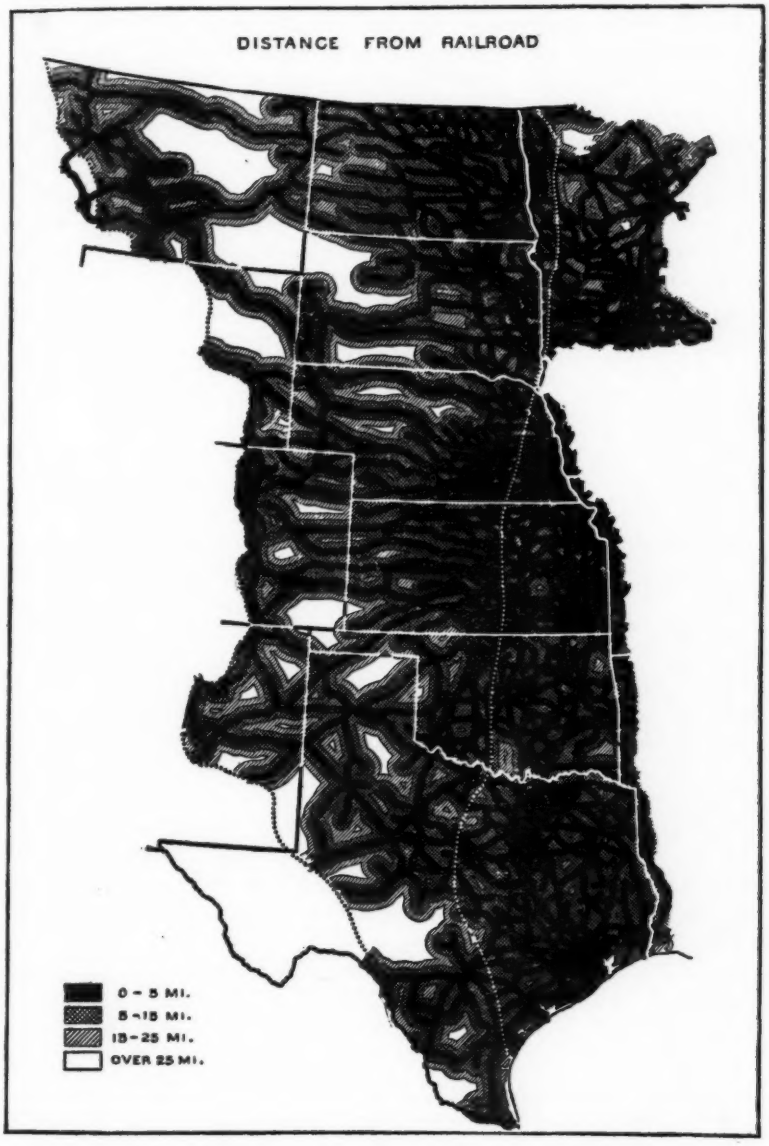



FIG. 17.—Distance from Railroad in Great Plains.

especially must be measured on the basis of value of products per farm, not of acreage. In no agricultural region in the United States is there greater range in productivity per acre than in the Great Plains.

*Changes in Size of Farms.*—The increase in acreage of farms, due principally to decreasing precipitation westward, is indicated in Fig. 18, in which three lines have been drawn, one through those counties where the average total acreage of land per farm is about 320 acres, one where it is about 640 acres, and one where it is about 1280 acres. In the Gulf Coastal Plain area these lines are only about 25 miles apart, which is closer than the natural conditions justify. The westward movement of crop farming into this area has been retarded by the ownership of the land by wealthy cattlemen, but the ranches are now being broken up and sold off in family sized parcels. Another census will probably show a movement westward of the 640 and 1280 acre lines in the area.

In central Kansas, where it has been 40 years since the land was homesteaded and agriculture has had ample time to adjust itself to the physical conditions, the lines are only about 75 miles apart, and are permanent, the shifting back and forth, as shown by the last four census returns, being seldom greater than the width of a county. The 320-acre size line in this winter wheat section corresponds roughly with $15 productivity per acre in 1919 and 25 inches average annual precipitation, the 640-acre size line with $7.50 per acre productivity and 20 inches precipitation. No county in Kansas has farms averaging as large as 1280 acres, but in the Texas Panhandle and in northwestern Nebraska where such county averages are found, the productivity ranges in general between $3 and $4 per acre. The average annual precipitation in northwestern Nebraska is about 16 inches, and in the portion of the Texas Panhandle considered it is about 18 inches. The size of farms across central and western Kansas increases about 3 1/3 acres per mile, while the productivity per acre in 1919 decreased about 8 cents per mile, and the average annual precipitation 1/16 to 1/20 inch per mile.

In North Dakota and Montana the zones between the acre-size farm lines spread out fan-like, the 640-acre line along the Canadian boundary being nearly 400 miles west of the 320-acre line, and the 1280-acre line about 100 miles further west. This divergence is noteworthy also on the productivity map, and is due to a less abrupt diminution of rainfall than further south. This belt between the 320 and 1280 lines of average acreage per farm covers much of the area of uncertain crop production. Its greater width in the spring wheat section of the Great Plains means that a larger area is here subject to the vicissitudes of

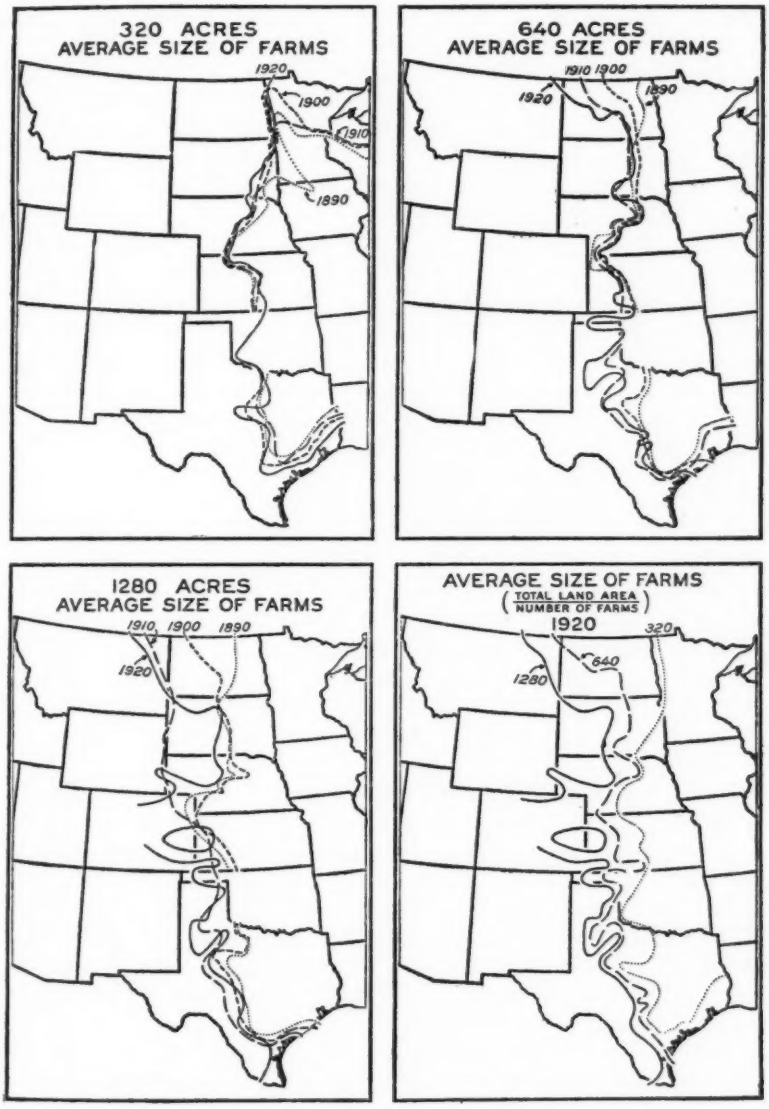



FIG. 18.—Changes in Average Area of Farms 1890-1920.

rainfall, and consequently that a larger number of farmers are involved in the alternating periods of prosperity and adversity.

It is interesting to note that in the Dakotas and Montana where this belt spreads out to a width of several hundred miles, there has developed out of the economic distress serious political dissatisfaction. In Nebraska, owing in large part to the Sand Hills, this belt of marginal crop land is very narrow; and in Kansas, as already noted, the 320, 640 and 1280 acre lines are only about 75 miles apart. Possibly there are not enough farmers in this belt of economic vicissitudes to make their influence felt politically in these states. Or it may be that the political peacefulness in Nebraska and Kansas is owing to the longer time since settlement and the accumulation of agricultural experience and capital. The existence of the Populist Party in these states some 40 years ago, which was a movement similar to the present movement in the spring wheat section, suggests that this greater accumulation of capital is, at least, a partial explanation.

Probably the greatest agricultural problem in the Great Plains region, more especially in the Farming-grazing and Grazing-forage crop belts, is the reorganization of the ownership of the land into units neither too small nor much too large for the support of a family according to the American standard of living. In Montana this will mean mostly consolidation of homestead holdings; whereas in parts of Texas it will involve division of large live-stock ranches. The area of these ultimate farm units will vary with the physical conditions, the distance from a railroad, and the capacity of the farmer, but will tend to approximate a gross production per farm equivalent to $4,000 to $5,000 in 1919.

Systems of Farming in the Great Plains.—With such a diversity of physical conditions as the Great Plains possess—from sub-tropical in southern Texas, where palms and bananas are grown for ornament and citrus orchards expectantly for profit, to sub-polar on the high plains beneath the mountains in northwestern Montana, where frosts occur in every month and no crops, except hay, are grown; from humid conditions along the eastern boundary to desert conditions in some of the valleys of the western portion—it is evident that there must be unusual variety in the systems of farming.

*Black-Earth Belt.*—Wheat farming is the simplest and also the most important system of farming in this belt. In both the spring wheat section in the Dakotas and the winter wheat section of western Kansas and Oklahoma and northern half of Texas, the farmers grow wheat as the cash crop and usually raise only enough oats to feed their horses, needed in seeding and harvesting the wheat, enough hay for a few

cattle to provide the household with milk and increase the income by the occasional sale of a steer, and enough corn in the northern areas, or sorghum in the southern, to supplement or supplant the hay.

In this system of wheat farming the seasonal distribution of labor is very uneven and unsatisfactory. In the spring wheat section especially peak loads come in the spring at plowing and seeding time and again at harvest time in the late summer and early autumn. Transient labor must be employed at high wages. During the winter, on the other hand, the farmer who grows little else than wheat has little to do. Obviously, a man who works only half the year cannot expect to make as much as one who works all the year. Hence, the trend toward diversification, especially the development of dairying in the spring wheat section and of cattle production in the winter wheat section, both of which systems of farming provide more work during the winter.

Moreover, the exclusive wheat farmer puts all his eggs in one basket, and the price is not determined by the millers in Minneapolis, as he sometimes thinks, but principally by world conditions as reflected in the Liverpool market. The present serious situation in the spring wheat section is due largely to the fact that wheat is a world crop, and the buying power of Europe is greatly reduced, while the production of wheat in many countries, Canada especially, has greatly increased. A campaign for diversification is in progress in the area, similar to the campaign for diversification during recent years in the South; and although the change in systems of farming will come slowly, it is probable that in the course of time western Minnesota and the Black-earth portions of the Dakotas will develop, like Eastern Minnesota and Wisconsin, into dominantly dairying districts. In 1920 over two-thirds of the farms in North Dakota had dairy cattle, these farms averaging seven dairy cows per farm, which is over double the average number in 1910.

The ultimate system of farming in the winter wheat districts of central Kansas and western Oklahoma is less clear, but probably it will be a more diversified system even than dairying, and one in which wheat, corn or kafir, and beef cattle will be the leading enterprises—a system similar to that in the southern portion of the Corn Belt.

In the Corn Belt section of this Black-Earth belt the present system of farming, based largely on corn, cattle, and hogs will doubtless continue dominant. Wheat, oats and hay are important crops in this section and probably will remain so. The system of agriculture in this section is one of the most satisfactory in the United States, and little change seems likely to occur.

In the Cotton Belt section of the Black-Earth belt a ten fold increase in wheat acreage, a three fold increase in the grain sorghums, and a two fold increase in cotton acreage occurred between 1909 and 1919, whereas the corn acreage diminished somewhat. Owing to the diverse topographic and soil conditions, there are several systems of farming in this section, and these will doubtless continue, but with increasing emphasis, probably, on cotton, because of the freedom from the boll weevil of large areas in this section. Crop systems of farming seem likely to continue encroaching upon livestock ranching, more particularly in the Staked Plains and Gulf Coast areas.

*The Farming-grazing Belt.*—In this belt it appears likely that the present major systems of agriculture will continue. These may be grouped into three general types:—(1) grain farming, (2) mixed grain and livestock farming, and (3) livestock ranching. The methods of grain farming will probably become more extensive in order to reduce the costs of production. The use of eight and even twelve horse rigs or traction outfits in plowing and seeding is likely to become more common, permitting the cultivation of a larger acreage per farm. In the mixed grain and livestock farming, live stock will be the chief dependence, the grain being grown on the more level land in the farm and the live stock grazed on the rougher or hilly land, also on the sand hills where the sand is not underlain with a heavier soil. Shallow sandy soils in this belt have proven to be the safest forage crop soils (corn and the sorghums), especially from southwestern Nebraska southward to Texas. The livestock ranching will be confined largely to the gravelly moraines, belts of badlands, and the sand hill areas, notably in Nebraska.

Cattle are at present the most important kind of live stock in this belt, and natural conditions suggest that they will always remain so. The system of cattle farming, however, will change, indeed, has changed. It has become sedentary with the passing of the land into private ownership and the fencing of the range, and will become more intensive as capital accumulates, prices of beef rise, and the importance of producing enough forage on the ranch to keep the cattle through the winter becomes more pressing. If the American standard of living is to be maintained, the farm or ranch must be big enough to carry about 100 head of cattle, which will mean, in general, from one to two sections of land (640 to 1280 acres), depending upon the carrying capacity of the range. In such livestock farms one or two hundred acres of the level land may be put in wheat, and about an equal amount in corn or sorghums for winter feed. Slowly the large ranches will be divided, as many have been in the past, and the small farms, on

the other hand, consolidated into units of this size. Not all the large ranches will be divided, however, nor all the small farms consolidated, because there are as great differences in men as in land. Every community needs one or more big farmers who have the capital to buy and introduce pure-bred stock, undertake experiments in methods of production, and serve in general as agricultural leaders of the community.

*The Grazing-forage Belt.*—In this belt, the annual value of the grazing exceeds the value of the crops, and the agriculture becomes dominantly pastoral. There is and probably will continue to be, however, the same three major types of farming as are found in the Farming-grazing belt to the east, but the grain farming system seems likely to become even less common and the livestock system more important. The grain farms are much the same size as in the belt to the east, because a section of land is all that a family can handle, even with the most efficient farm machinery. The live stock farms are larger than in the moister belt because the carrying capacity of the pastures is lower. Two to four sections of land are required, in general, to carry 100 cattle, and in addition most of the cattle ranchers will put in a hundred acres or so of forage for winter feed.*

*Arid and "Badlands" Grazing Areas.*—Lastly, we come to the arid areas, the sand hills, the "breaks" and "badlands," which occupy in all about 70 million acres in the Great Plains region. Most of the sand hills, the "breaks" and "badlands," and the moister portions of the arid areas are used for grazing cattle; but the herding of sheep, doubtless, will continue to be the principal system of farming in the drier districts. In general, outside of Texas, this is a primitive, migratory system of farming, if such it may be called, in which the shepherd moves about with his flock as he did in David's time. But the arid districts undoubtedly will be fenced in time, and the sheep industry become more sedentary. More than four sections of land will be required, probably, to support a profitable sheep outfit in these driest districts. In the Edwards Plateau area this sedentary system of livestock management is well developed, but includes cattle and goats ranged on the same land with the sheep. In Sutton County in this

* Since this paper was written the bulletin by M. L. Wilson entitled "Dry Farming in the North Central Montana Triangle" has been published, Montana State College Exten. Serv., 66. This noteworthy discussion by the most competent authority on the agriculture of the semi-arid sections of the northern Great Plains, though urging diversification and live stock, still advises wheat as a cash crop for this most arid portion of the northern Plains.

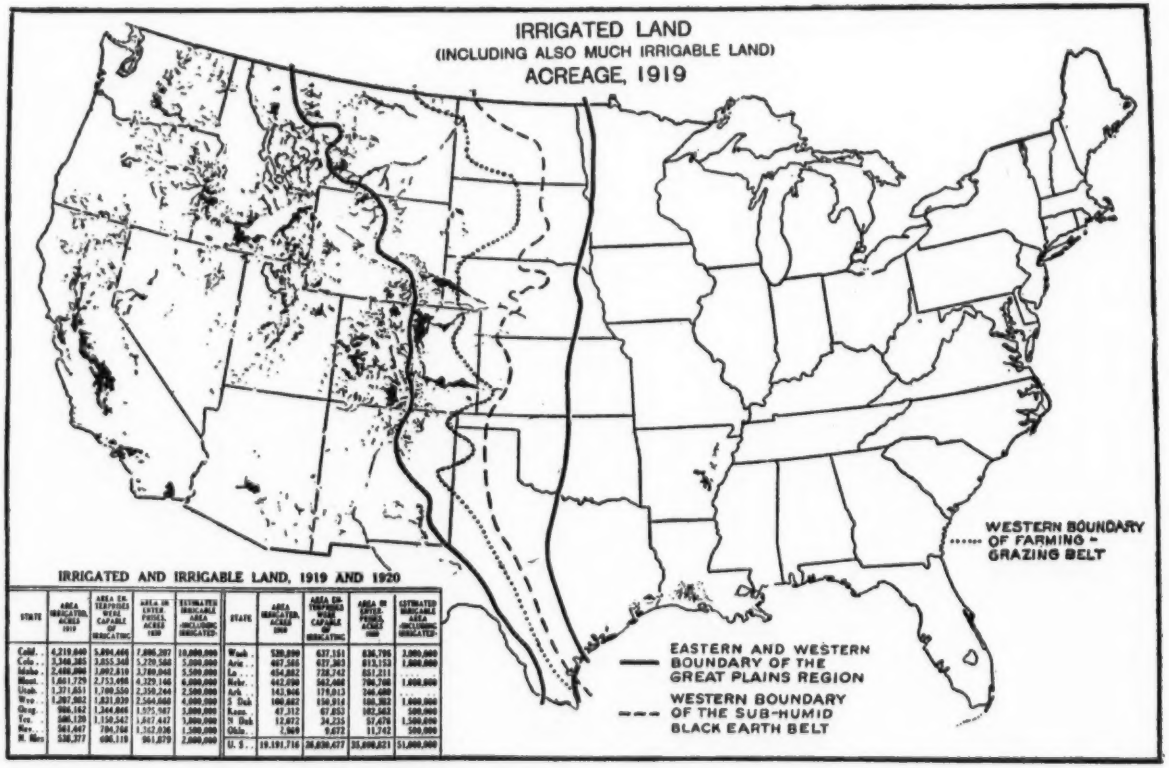
area nearly two-thirds of the farms are between 4 and 20 sections in size.*

*The Irrigated Districts.*—The agriculture of the irrigated districts, which are located mostly in these arid areas, is important in the Great Plains, and will undoubtedly become more important with the passage of time. It has not been described because it is not characteristic of the Great Plains region. The general system of farming in the irrigated districts, like that along the northern margin of the Corn Belt, is based on some intertilled crop, usually corn or sugar beets, followed by a small grain, usually wheat, and then by hay, commonly alfalfa, which may occupy the land for several years, and be pastured incidentally. Quite commonly both cattle and sheep are brought down off the plains into the irrigated districts during the winter and fed beet pulp or corn fodder, supplemented sometimes with grain. The irrigated lands are a steadying force in the agriculture of the arid and semi-arid portions of the Great Plains region, and often provide school and church facilities that, owing to the sparsity of settlement, the stockmen could not otherwise afford.

The Agricultural Outlook.—The farmers and ranchers of the Great Plains region at present are facing a dilemma. The demand for wheat is decreasing, owing to exhaustion of the purchasing power of European peoples, and prices are falling. The demand for cattle is also declining, and prices are below pre-war levels, owing to a change in our national diet involving decreasing consumption of beef. The per capita consumption of beef in the United States dropped from 90 pounds in 1907 to 65 pounds in 1921, and the number of beef cattle in the United States is less than it was 25 years ago.

Wheat and beef are the two most important products which the farmers of the Great Plains, outside the cotton section and arid areas, have to sell to the world. Sheep are important in the arid areas, but have been gradually pressed out of the moister lands by wheat and cattle. In general, the alternative to wheat is beef cattle, and the alternative to beef cattle is sheep. Land which is worth 25 dollars an acre for wheat is normally worth only 5 to 10 dollars an acre for grazing cattle, and 4 to 8 dollars an acre for sheep. A change in system of farming from wheat to beef, therefore, unless the wheat-land be used for feed grains and forage crops, which involves additional capital, generally

*"An Economic Study of a Typical Ranching Area on the Edwards Plateau of Texas," by Youngblood and Cox, Texas Agricultural Experiment Station, Bul. 297, page 109. This notable contribution to Range Economics should be read by all interested in the subject.


IRRIGATED LAND
(INCLUDING ALSO MUCH IRRIGABLE LAND)
ACREAGE, 1919
WESTERN BOUNDARY OF FARMING - GRAZING BELT
EASTERN AND WESTERN BOUNDARY OF THE GREAT PLAINS REGION
WESTERN BOUNDARY OF THE SUB-HUMID BLACK EARTH BELT

IRRIGATED AND IRRIGABLE LAND, 1919 AND 1920

| STATE | AREA IRRIGATED, ACRES 1919 | AREA ER. TEMPORES WERE CAPABLE OF IRRIGATING | AREA IN ENTER PRISES, ACRES 1920 | ESTIMATED IRRIGABLE AREA (INCLUDING IRRIGATED) | STATE | AREA IRRIGATED, ACRES 1919 | AREA ER. TEMPORES WERE CAPABLE OF IRRIGATING | AREA IN ENTER PRISES, ACRES 1920 | ESTIMATED IRRIGABLE AREA (INCLUDING IRRIGATED) |
|---|---|---|---|---|---|---|---|---|---|
| Calif. | 4,219,640 | 5,894,448 | 7,686,287 | 10,000,000 | Wash. | 520,000 | 637,151 | 636,795 | 1,000,000 |
| Colo. | 3,348,385 | 3,855,348 | 5,279,568 | 5,000,000 | Ariz. | 467,565 | 637,303 | 813,153 | 1,000,000 |
| Idaho | 2,488,000 | 3,092,810 | 3,780,848 | 5,500,000 | La. | 454,882 | 728,742 | 851,211 | |
| Mont. | 1,661,729 | 2,753,498 | 4,329,146 | 6,000,000 | Nebr. | 442,000 | 562,488 | 704,708 | 1,000,000 |
| Utah | 1,371,651 | 1,700,550 | 2,350,264 | 2,500,000 | Ark. | 143,946 | 179,013 | 246,680 | |
| Wyo. | 1,287,982 | 1,831,020 | 2,564,660 | 4,000,000 | S. Dak. | 100,662 | 150,916 | 186,382 | 1,000,000 |
| Oreg. | 986,162 | 1,344,848 | 1,975,987 | 3,000,000 | Kans. | 47,312 | 67,853 | 102,562 | 500,000 |
| Tex. | 548,139 | 1,150,542 | 1,617,447 | 3,000,000 | N. Dak. | 12,872 | 34,235 | 57,479 | 1,500,000 |
| Nev. | 561,447 | 704,768 | 1,162,026 | 1,500,000 | Okla. | 2,969 | 9,672 | 11,742 | 500,000 |
| N. Mex. | 538,377 | 686,119 | 961,879 | 2,000,000 | U. S. | 19,191,716 | 28,030,477 | 35,098,821 | 51,000,000 |

FIG. 19.—Acreage of Irrigated Land.

means bankruptcy for the wheat farmer, and from beef to sheep is likely to spell a similar fate for the cattleman.*

Because of these established land values, whose deflation means bankruptcy, as well as because of the smaller area and different organization and equipment of their farms, wheat farmers persist in growing wheat even when the price is far below the cost of production. Similarly cattlemen are slow to shift to sheep. Their ignorance of and dislike for sheep is also a deterring influence. It is easy for farmers to climb the ladder of rising land values from sheep to cattle and cattle to wheat, but deflation means disaster.

Happily the normal trend, owing to increasing population, is toward more intensive use of the land. The present export surplus of wheat, one-fifth to one-quarter of our production, will be required by the increase in population within 20 years; and partial replacement of wheat by other crops in the humid portions of the United States, where half of the enormous increase in wheat acreage between 1909 and 1919 occurred, will shorten materially this period of surplus. In fact, the next season, 1920, other crops were substituted for two-thirds of the 14 million acres increase in wheat acreage in the humid region during the decade, and the acreage is now (1923) nearly back to pre-war levels. In the sub-humid Black-Earth belt, where one-quarter of the increase in wheat acreage between 1909 and 1919 occurred, it is more difficult to replace wheat by other crops because the farm organization and equipment are suited primarily to wheat production; nevertheless, in 1920 other crops were substituted for one-half of the seven and one-half million acres increase in wheat in this belt between 1909 and 1919, and the acreage is now back to the pre-war level. In the semi-arid belts, where one-quarter of the increase in wheat acreage occurred, practically the only alternatives to wheat are forage crops and grazing, and the acreage of wheat has not declined appreciably since 1919. There are about 15 million acres in these semi-arid belts on which the sod has been broken and which, apparently, at the present prices of cattle and forage crops, can be used only for wheat, or left idle.

The prospect for the cattle industry is not reassuring. If in these present times of urban prosperity the demand for beef is insufficient to raise the price above pre-war levels, it does not seem likely to increase during the quieter times which must be expected soon. It may develop, however, that population will increase more rapidly than

* Just at present, the price of wool and lambs is so high (fully double the pre-war price, whereas beef cattle and wheat are practically at pre-war prices) that sheep are pressing in upon the cattle range.

per capita consumption decreases, in which case the price of beef and the prosperity of the industry will improve.

Thus to the inexperience of many farmers in the systems of agriculture adapted to the varying physical conditions in the Great Plains, and to deficiency of capital which characterizes all pioneer regions, there have been added recently two more obstacles to agricultural progress, an appalling decline in the price of wheat and a price for beef which remains stationary at pre-war levels. The Great Plains region presents the most pressing problems in American agriculture, and deserves all the help which national and state agencies for the promotion of agriculture can offer.